

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Education as a Strategy for Managing Occupational-related Musculoskeletal Pain: a scoping review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-032668
Article Type:	Research
Date Submitted by the Author:	02-Jul-2019
Complete List of Authors:	<p>Palsson, Thorvaldur; Aalborg University, Department of Health Science and Technology Boudreau, Shellie; Aalborg University Høgh, Morten ; Aalborg University, Department of Health Science and Technology Herrero, Pablo; San Jorge Univ, Physiotherapy Bellosta-Lopez, Pablo ; University of San Jorge Faculty of Health Sciences, Department of Physiotherapy Domenech-Garcia, Victor ; University of San Jorge Faculty of Health Sciences, Department of Physiotherapy Langella, Francesco; IRCCS Istituto Ortopedico Galeazzi, Orthopedic & Traumatology Gagni, Nicolo; IRCCS Istituto Ortopedico Galeazzi, Orthopedic & Traumatology Christensen, Steffan ; University College of Northern Denmark , School of Physiotherapy Villumsen, Morten ; Aalborg Municipality</p>
Keywords:	Work-related musculoskeletal pain, Education, PAIN MANAGEMENT

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Education as a Strategy for Managing Occupational-related Musculoskeletal Pain: a scoping review

Thorvaldur Skuli Palsson¹, Shellie A. Boudreau², Morten Høgh¹, Pablo Herrero³, Pablo Bellosta-López³, Victor Domenech-Garcia³, Fransceso Langella⁴, Nicolò Gagni⁴, Steffan Wittrup Christensen^{1,5}, Morten Villumsen⁶

¹Department of Health Science and Technology, SMI[®], Aalborg University, Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

²Center for Neuroplasticity and Pain (CNAP), Department of Health Science and Technology, SMI[®], Aalborg University, Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

³Department of Physiotherapy, University of San Jorge, Campus Universitario Villanueva de Gállego, Autovía Mudéjar, km. 299, 50830 Villanueva de Gállego, Zaragoza, Spain

⁴IRCCS Galeazzi Orthopedic Institute, Via Riccardo Galeazzi, 4, 20161 Milano MI, Italy

⁵ School of Physiotherapy, University College of Northern Denmark, Selma Lagerløfs Vej 2 9220 Aalborg, Denmark

⁶Aalborg Municipality, Storemosevej 19, 9310 Aalborg, Denmark

Corresponding author

Thorvaldur Skuli Palsson

Associate Professor (PhD)

Department of Health Science and Technology, SMI[®], Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

tsp@hst.aau.dk

Telephone: +4599407518

Fax: +4599407520

1
2
3 **Keywords:** Work-related musculoskeletal pain, Pain Education, Pain management
4

5 **Word count:** 2838 words
6
7
8
9

10 **Abstract**

11
12
13
14

15 **Background:** Musculoskeletal (MSK) pain is the primary contributor to disability worldwide.

16
17 There is a growing consensus that MSK pain is as a recurrent multi-factorial condition
18
19 underpinned by health and lifestyle factors. Studies suggest that education on work-related

20
21 pain and individualized advice could be essential and effective for managing persistent MSK
22
23 pain. **Objective:** The objective of this scoping review was to map the existing evidence of the
24
25 effects of implementing educational strategies in the workplace on managing work-related

26
27 MSK (WRMSK) pain. **Methods:** This scoping review assessed original studies that implemented
28
29 and assessed education as a strategy to manage WMSK pain. Literature search strategies were

30
31 developed using thesaurus headings (i.e. MeSH and CINAHL headings), and free-text search
32
33 including words related to MSK in an occupational setting. The search was carried out in

34
35 PUBMED, CINAHL, COCHRANE LIBRARY and WEB OF SCIENCE. **Results:** A total of 19 peer-
36
37 reviewed articles were included and the study design, aim, and outcomes were summarized.

38
39
40
41
42 **Conclusions:** Educational resources may be beneficial for managing work-related MSK pain as

43
44 a stand-alone strategy and/or in combination with other approaches, such as physical activity.

45
46
47 The benefits of implementing educational resources for managing WMSK pain may stem from
48
49 behavior changes within and outside the workplace. Delivering the education electronically

50
51 may be most feasible and efficient.
52
53
54
55
56
57
58

59 **Strengths and limitations**

60

- The study design allowed for including literature from non-randomized studies to investigate the role of education for managing work-related musculoskeletal pain
- The study presents a broad overview of resources available for healthcare professional and the general public regarding work-related musculoskeletal pain
- Relevant studies conducted in working populations may have been excluded if the article did not state that the focus was on work-related pain
- Including non-randomized studies limits the generalization of findings and determining the overall effect

Introduction

Musculoskeletal (MSK) pain is the primary contributor to disability worldwide (GBD 2016 Disease and Injury Incidence and Prevalence Collaborators et al., 2017). The socioeconomic impact of MSK pain-related disability and associated absenteeism affects the individual worker, the family, the worker's organization, and society (Dagenais et al., 2008; Hartvigsen et al., 2018; McDonald et al., 2011; Vlaeyen et al., 2018). Studies on physical demands of workload yield information on how greater physical loads affect factors such as sickness absence (Burdorf and Jansen, 2006; da Costa and Vieira, 2010). However, direct benefits such as prevention of work-related MSK (WMSK) (Hoe et al., 2018; Verbeek et al., 2012) remain elusive. In fact, the physical demands of workloads, such as external loading, fail to sufficiently explain the rising prevalence of WMSK pain amongst the working population. There is a growing consensus and an increasing understanding that MSK pain is a recurrent multifactorial condition underpinned by health and lifestyle factors (Hartvigsen et al., 2018; Jensen et al., 2010; Rashid et al., 2017). Therefore, strategies for addressing WMSK pain require re-conceptualization (Jensen et al., 2010; Nicholas, 2018; Sennehed et al., 2018) and inclusion of multifactorial approaches. Ultimately, re-conceptualizing the understanding of WMSK pain would imply an abandonment of a direct (causal) relation between work-related factors (e.g. sitting, lifting, and load) and WMSK pain. Instead, work-related factors should be considered one of many contributors to WMSK pain (Vlaeyen et al., 2018).

Long-term absenteeism contributes to an increase in an individuals' sense of helplessness and reduction in self-efficacy which may stem from negative recovery beliefs, low sense of mastery, and perceived high mental demands at work (Busch et al., 2007). From a socioeconomic perspective, enabling individuals return or continue to work despite having episodes of recurrent pain may be beneficial for the individual worker and the organization

1
2
3 (Curnock et al., 2016). In this perspective, organizations should adopt a broader approach
4
5 towards ensuring workability and pain management instead of solely focusing on prevention
6
7 and management of WMSK pain (Rasmussen et al., 2016).
8
9

10 Studies show that successful rehabilitation of people with WMSK depend upon
11
12 collaboration and communication between the organization, managers, and the individual
13
14 worker (Sennehed et al., 2018; Sultan-Taieb et al., 2017). Furthermore, studies suggest that
15
16 education on work-related pain and individualized advice could be essential for the
17
18 management of persistent MSK pain (Gardner et al., 2019; Tegner et al., 2018; Traeger et al.,
19
20 2018). In particular, communication including non-threatening information about MSK pain
21
22 could reduce absenteeism (Frederiksen et al., 2017; Ree et al., 2016). However, an overview
23
24 of educational material or implementation strategies for pain management within the
25
26 workplace and the effects of employee education on managing WMSK pain are lacking.
27
28
29
30
31

32 The objective of this scoping review was to map the existing evidence of the effects of
33
34 implementing educational strategies in the workplace on managing MSK pain.
35
36

37 **Methods**

38 *Study design and literature search strategies*

39
40 This scoping review included original studies that implemented and assessed education as a
41
42 strategy to manage WMSK pain. A scoping review was chosen as a starting point to get a broad
43
44 overview of any existing evidence in the field. The reporting of this scoping review follows the
45
46 PRISMA-ScR guidelines (Tricco et al., 2018)
47
48
49
50

51 For the purpose of this scoping review, educational strategies were defined as an
52
53 initiative designed to educate the employees with the aim of promoting occupational health
54
55 in the workplace. Additionally, management strategy was defined as a method aimed at
56
57 preventing or reducing the burden of MSK pain in an occupational setting. Studies were
58
59
60

1
2
3 included if the effect of education was assessed in any way (i.e. as the primary intervention or
4 control) and if they were i) based on peer-reviewed research articles performed on adult
5 humans (above 18 years), ii) had full-text available in English, iii) were focused on
6 occupational-related pain in a working population, and iv) described management strategies
7 aimed at promoting retention or wellbeing in the work place. Studies were excluded in the
8 screening process if i) no abstract was available, ii) they focused on developing materials or
9 methodology only (e.g. development of questionnaires), or iii) they were prevalence studies.
10
11
12
13
14
15
16
17
18
19

20 Literature search strategies were developed using thesaurus headings (i.e. MeSH and
21 CINAHL headings), and free-text search including words related to MSK in an occupational
22 setting. The search was carried out in PUBMED, CINAHL, COCHRANE LIBRARY and WEB OF
23 SCIENCE. According to the indexing in PUBMED, the MeSH term "*musculoskeletal pain*" only
24 covers the terms *myalgia* and *pelvic girdle pain*. Therefore, the MeSH terms "*Neck pain*",
25 "*Back pain*" and "*Shoulder pain*" were added in the PUBMED search, as these were the areas
26 considered to be most frequently investigated and reported in relation to occupational-
27 related MSK pain (Parent-Thirion et al., 2017). For a detailed description of the search strategy
28 in each database, see table 1. No restrictions on publication year were applied in order to
29 enable full mapping of the area. When all records had been identified using the selection
30 criteria, the reference lists of the included studies were screened to identify additional
31 relevant studies. A Prisma diagram was used to document the screening process as
32 recommended (Moher et al., 2009).
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Search strategy for all the included databases.

Source	Thesaurus headings / free-text search	Results	Date of search
PUBMED	Occupational health	29074	14.02.2019
	Musculoskeletal pain	3864	
	Neck pain	6264	
	Back pain	35590	
	Shoulder pain	4331	
	"Occupational health" AND "Musculoskeletal pain"	288	
	((("Musculoskeletal Pain"[Mesh]) OR "Neck Pain"[Mesh]) OR "Back Pain"[Mesh]) OR "Shoulder Pain"[Mesh])) AND "Occupational Health"[Mesh]	410	
CINAHL	Occupational health	39950	11.02.2019
	Musculoskeletal pain	3943	
	"Occupational health" AND "musculoskeletal pain"	125	
Cochrane database	Occupational health	562	14.02.2019
	musculoskeletal pain	694	
	"Occupational health" AND "musculoskeletal pain"	135	
	("Occupational health" [Mesh]) AND ("musculoskeletal pain" [Mesh])	40	
Web of Science	"Occupational health" AND "musculoskeletal pain"	155	12.02.2019
Total number of hits		1153	

Educational and information sources for employees

Various educational resources regarding occupational health are available to the public in an online format, e.g. the European Agency for Safety and Health at Work website (www.osha.europa.eu). Although the credibility of these resources cannot be evaluated in a scoping review, a mapping of such resources was performed to obtain a broad overview of available educational resources for employees regarding MSK pain and how to self-manage WMSK. For these purposes, a free-text Google search was conducted using search terms relating to MSK in the workplace. Only resources from public authorities and trade unions in Europe were included in the search.

Study selection and synthesis of results

The screening process consisted of two steps and an overview can be seen in figure 1.. In the first step two investigators (TSP and SAB) independently identified potentially eligible articles resources by screening the title and abstract. In the second step, the same investigators reviewed a full-text version of the articles for eligibility. If consensus was not reached, a third member of the research group (MV) had the final vote.

In the first step, articles were considered potentially eligible if the effects of education in an occupational setting where MSK pain was specifically evaluated. Education focused on the employees' understanding or knowledge on how to prevent and/or manage MSK pain in an occupational setting.

The objective of this scoping review was to map existing evidence. Thus, no attempt was made to critically evaluate the methodology or the overall confidence of the results in the included articles (Arksey and O'Malley, 2005). To map the existing evidence, the study design,

1
2
3 objectives, and main findings from the eligible articles were summarized and tabulated (table
4
5
6 2). The goal the scoping review was to then provide an overview based on a qualitative
7
8 synthesis covering the following three themes:

- 10 • The overall outcome of using education to manage occupational-related MSK pain
- 11
- 12 • Potential influence of delivery method
- 13
- 14
- 15 • The individual workers' subjective evaluation of the educational intervention for
- 16
- 17 managing their occupational-related MSK pain
- 18
- 19

20 The qualitative synthesis included a distinction between the mode of education delivery,
21
22 which covered booklet/pamphlet, electronic resources (landing page or website), face-to-
23
24 face, or a combination.
25
26
27
28
29

30 *Patient and Public Involvement*

31
32 For this scoping review, patients' priorities, experience and preferences were not involved in
33
34 the design of the study, forming the aims, search strategies or data-syntheses. Study findings
35
36 will be disseminated on a publicly-available platform (websites and on social media).
37
38
39
40
41
42

43 **Results**

44
45 After duplicate removal, the search strategy revealed 1015 articles. . As outlined in figure 1,
46
47 after excluding articles that did not fulfill the inclusion criteria based on screening of title and
48
49 abstract, 87 articles were included for full-text screening. Following full-text screening
50
51 additional 67 articles were excluded, leaving 19 peer-reviewed articles for final inclusion. The
52
53 included studies are listed in table 2 where information regarding study design, aim of the
54
55 study, and outcomes of the three themes are presented.
56
57
58
59
60

Table 2. The articles are presented in a chronological order. The table depicts the study design, aim, and outcome of each study.

Author	Study design	Main aim of study	Outcome
(Farrokhnia et al., 2018)	Prospective cohort study – single arm	Evaluate the effect of education related to good body posture and stretching exercises	A significant reduction in musculoskeletal pain in neck, right shoulder, left shoulder, upper back, and right wrist following the educational intervention
(Korshøj et al., 2018)	Randomized controlled trial	Evaluate the effect of aerobic exercise on musculoskeletal pain at 4- and 12-months follow-up. The aerobic exercise group was compared with a health promotion group receiving lectures	Clinically significant reductions in pain intensity for neck, shoulders, arms/wrists in the aerobic exercise group, compared to the education group A reduction in low back pain within the health promotion group evident at 12-month follow-up.
(Rantonen et al., 2016)	Prospective quasi experimental study	To assess cost-effectiveness of a patient information booklet for employees in forestry company reporting mild LBP	Combination of booklet information and face-to-face advice reduced the costs of health care (87 % probability), but the additive effect (compared to booklet alone) was negligible.
(Ratzon et al., 2016)	An assigned randomized control trial	To examine the effect of a personalized ergonomic intervention, focusing on body posture during common work tasks, as compared to a control group receiving instructions sheets and explanations of principles of proper work performance, for hospital nurses with musculoskeletal pain	No significant differences were found in the level of pain or number of painful body regions or in the level between the intervention and control group that only got information/education in writing (no practical exercise/instructions)
(Hutting et al., 2015b)	A randomized control trial	To evaluate the effectiveness of a self-management	No significant between-group differences were found on most outcome measures, although the self-management

		intervention (including an eHealth module), compared with usual care, in employees with chronic, non-specific complaints of the arm, neck or shoulder	intervention improved the participants' perceived disability during work.
(Slaughter et al., 2015)	A prospective, single arm experimental Study	To provide evidence-based education online for the management of acute low back pain amongst nurses. Subsequently, to test the effectiveness of this online education	Statistically significant improvements could be seen in knowledge and levels of confidence related to self-management. The intervention was also considered cost-effective
(Wanyonyi et al., 2015)	Mixed methods study	To determine the level of ergonomic knowledge of workers and the prevalence of WRMD, and the effect of a knowledge-based ergonomic intervention consisting of an educative slideshow supplemented by exercise pamphlets for home program exercises as well as office exercises for the highly affected body areas	The intervention resulted in a behavior change amongst many participants where physical activity was implemented into the work day. It was mentioned that being active helped relieving pain The work environment and habits may be difficult to change Knowledge regarding ergonomic changes in the workplace need to be provided on a regular basis
(Aghilinejad et al., 2014)	Randomized controlled trial	To assess the effect of 3 ergonomic training programs on the prevalence of low back pain among workers of an Iranian automobile factory	The prevalence of back pain did not change in the groups that got a lecture or a pamphlet only. However, the prevalence of LBP experienced in the previous year significantly decreased from 42% to 23% in participants who participated in the workshop.
(Rantonen et al., 2014)	Randomized controlled trial	To determine the effectiveness of face-to-face education information for employees in forestry company reporting	Face-to-face information in addition to booklet information was not more effective in managing low back pain than providing the booklet only

		mild LBP at reducing LBP disability, sickness and absence days	
(Caspi et al., 2013)	A prospective cohort study	To test the feasibility of a multicomponent pilot intervention to improve worker health through involvement of unit managers, implementation of unit-wide safety changes, and worker education	No change was seen in musculoskeletal pain or physical activity levels
(Meinert et al., 2013)	A prospective, single arm intervention study	To examine the effects of a Web-based office ergonomics intervention on subjects' individual workplace adjustments	Self-reported musculoskeletal complaints and headache symptoms decreased significantly after the intervention
(Gram et al., 2012)	Randomized controlled trial	To investigate whether an exercise intervention shown to increase aerobic capacity, would also lead to less musculoskeletal pain; improved work ability, productivity, and perceived physical exertion; and less sick leave	The active arm in the study resulted in improved aerobic capacity but the intervention was no more effective in improving musculoskeletal pain and other work-related factors than the educational
(Rantonen et al., 2012)	Randomized controlled trial	Evaluate the effectiveness of two active interventions, aimed at secondary prevention of low back pain (LBP), in occupational health. The rehabilitation group got intensive rehabilitation with a biopsychosocial approach whereas the control group only got an intervention consisting of a book focusing on the beliefs	The two multidisciplinary and active interventions reduced LBP, sickness absence and physical impairment among employees who were fit to work but reported moderate level LBP. The active intervention showed a greater improvement. The rehabilitation group had fewer days of sickness absence. No difference was seen in disability between the two groups and in general, the effect sizes were small

		and encouragement to stay active	
(Blangsted et al., 2008)	Randomized controlled trial	To evaluate the effect of two different worksite physical-activity interventions on neck–shoulder symptoms, together with perceived work ability and sick leave among office workers	The exercise groups experienced a significant reduction in symptoms compared with controls, who only got information regarding health-promotion initiatives No difference was seen in sick leave or work ability scores the last three months of the intervention
(de Boer et al., 2007)	A prospective intervention study	To investigate the effectiveness of a counselling and education program on work ability and work disability pension for employees in the construction industry	No significant effect was seen on work ability or disability pension
(Frost et al., 2007)	A cluster-randomized control trial	To test the effects of giving evidence-based information addressing psychosocial risk factors for pain-related disability in isolation (control group) or in addition to a screening of workplaces for physical health hazards. The outcomes of interest were new episodes and duration of pain-related and general absence from work.	No positive effect was seen from the two interventions on neither the number of new pain episodes nor absence from work
(Feuerstein et al., 2000)	A prospective intervention study	To investigate whether a group intervention consisting of 11 educational sessions addressing several work-related factors would reduce occupational-related musculoskeletal pain	A significant reduction in pain-related problems in the upper extremities was seen The cost related to indemnity and utility of the healthcare system were likewise reduced

		and improve stress management	
(Hazard et al., 2000)	Randomized control trial	To test the ability of an educational pamphlet to improve recovery in terms of pain, work status, and healthcare utilization after occupational low back injury	The pamphlet had no significant impact on pain severity or reduction, healthcare visits, or work absence. Of the 56% of those who received the pamphlet thought it had provided useful information, but only 11% thought it had helped them return to work more quickly
(Videman et al., 1989)	A prospective, group comparison intervention study	To evaluate the effect of training on patient-handling skills and prospectively to assess the effect of skill on subsequent back pain and back injuries in nursing	Back pain was independent of patient-handling skill and the difference between the trained and control groups was not statistically significant

Characteristics of included studies

Of the 19 studies included, 10 studies were randomized controlled trials (Aghilinejad et al., 2014; Blangsted et al., 2008; Frost et al., 2007; Gram et al., 2012; Hazard et al., 2000; Hutting et al., 2015b; Korshøj et al., 2018; Rantonen et al., 2014, 2012; Ratzon et al., 2016). Eight studies utilized a prospective design where educational management strategies were tested using one (Caspi et al., 2013; Farrokhnia et al., 2018; Feuerstein et al., 2000; Meinert et al., 2013; Slaughter et al., 2015) or two groups (de Boer et al., 2007; Rantonen et al., 2016; Videman et al., 1989). One study (Wanyonyi et al., 2015) utilized a mixed methods design to assess the individual workers' experience of the educational intervention.

Synthesis of findings

The overall outcome of using education to manage occupational-related MSK pain

In general, a map of the existing evidence indicates that an educational intervention positively affects the physical load on the musculoskeletal system at the workplace, especially when including factors such as absence from work (Blangsted et al., 2008; de Boer et al., 2007; Hazard et al., 2000; Rantonen et al., 2016, 2012) and cost-benefits of staying at work despite pain (Feuerstein et al., 2000; Rantonen et al., 2016; Slaughter et al., 2015). The included studies were heterogeneous with regards to study design; some were lacking comparators (Caspi et al., 2013; Farrokhnia et al., 2018; Feuerstein et al., 2000; Meinert et al., 2013; Slaughter et al., 2015) or focused on improving physiological parameters such as aerobic capacity (Gram et al., 2012; Korshøj et al., 2018) and strength (Blangsted et al., 2008). See table 2 for an overview of the main findings of the included studies.

Potential influence of delivery method

The available literature was inconclusive with respect to determining additional benefits of combining an educational intervention with a more active approach (i.e., additional verbal education, exercise, or multidisciplinary rehabilitation). Combining education with active interventions or approaches, such as ergonomic advice or exercise, was suggested to have additional benefits (Aghilinejad et al., 2014; Rantonen et al., 2012), although inconsistent findings were evident (Frost et al., 2007). For example, combining an educational booklet with face-to-face advice resulted in little or no additive effect on low back pain as assessed by pain levels, cost, or absence from work (Rantonen et al., 2016, 2014). A face-to-face intervention however may ensure better retention of the educational information as compared to electronic delivery, such as through email (Wanyonyi et al., 2015).

The individual workers' subjective evaluation of an educational intervention

Three of the included studies (Hutting et al., 2015b; Slaughter et al., 2015; Wanyonyi et al., 2015) evaluated the subjective experience of participation in the study. Hutting et al. investigated how six different online (eHealth) modules were received by the participants (Hutting et al., 2015b). Overall, this initiative was considered positive as it provided the participants with insight into their own condition and on how they could influence it themselves by implementing behavior changes in- and outside the workplace. Behavioral change can be facilitated by the information in the provided material regarding e.g. ergonomics and exercise (at home and in the workplace). As a result, participants felt more confident in self-managing their pain condition (Slaughter et al., 2015; Wanyonyi et al., 2015). In contrast to this, many workers may find it challenging to implement changes in their

1
2
3 workplace as this might require unavailable resources (e.g. office furniture and/or assistive
4
5 equipment) (Wanyonyi et al., 2015).
6
7
8
9

10 *Educational and information sources for the general public*

11
12 A number of resources were found in several European countries (appendix i). The available
13
14 material was presented in writing, infographics, or video. The results from the literature
15
16 search indicate an abundance of material. This material was available in generic and less
17
18 often, occupational specific, for employees in several European languages.
19
20
21
22
23
24

25 **Discussion**

26
27 This scoping review aimed at mapping the evidence for using educational initiatives for MSK
28
29 pain at the workplace. The overall findings are inconclusive with regards to determining
30
31 whether education as a stand-alone management strategy for WMSK pain may be beneficial.
32
33 Also, it is unclear whether there is a superior mode of delivery and whether education needs
34
35 to be combined with other initiatives, to achieve the desired benefits.
36
37
38
39
40
41

42 *Education as a mean to manage work-related musculoskeletal pain*

43
44 It is clear from the literature presented in this scoping review (table 2) that education, as a
45
46 means for managing MSK pain at the workplace may be beneficial, although other active
47
48 approaches might have a better effect. This was evident in some of the included studies
49
50 (Aghilinejad et al., 2014; Rantonen et al., 2012). However, it is reasonable to expect a dose
51
52 response relationship between the attention given to the individual and the perceived
53
54 outcome. In other words, it may seem that simply offering more services or options, relevant
55
56 to the job function and/or individual may have an additive effect on the outcome.
57
58
59
60

1
2
3 The availability of educational material also seems to matter, i.e. that the employee feels
4 that educational material can be accessed when needed (Hutting et al., 2017). Also, it may be
5
6 important that the intervention is directly related to the work functions of the employee in
7
8 order to secure the relevance (Doda et al., 2015). When developing an eHealth educational
9
10 module aimed at employees with MSK pain in the upper extremities and neck, Hutting et al.
11
12 demonstrated a need to address both generic and specific work functions (Hutting et al.,
13
14 2015a). By using an eHealth module for such purposes, employees gained insight and
15
16 awareness about their complaints which ultimately improved acceptance and coping
17
18 strategies (Hutting et al., 2017). The educational information therefore should aim broadly
19
20 and include the etiology of the pain experience, how emotional factors may play a role, how
21
22 to deal with a high workload, considerations of available work capacity, and the ability to set
23
24 limits. The educational material should aim to improve the employee's knowledge of the work
25
26 environment, including communication with colleagues and superiors, which may involve how
27
28 to ask for help (Wanyonyi et al., 2015).
29
30
31
32
33
34
35
36

37 Even though educational booklets may not be effective in preventing the onset of MSK
38
39 pain, such as low back pain, beneficial may emerge as promoting behavioral change, modifying
40
41 health beliefs, and improving attitudes (Shorthouse et al., 2016). This is supported by
42
43 information from one of the included articles (Wanyonyi et al., 2015), where the educational
44
45 material was found to promote behavioral change, when the participants adopted a more
46
47 active lifestyle at work and during leisure time. When weighing the effort against the potential
48
49 gain, it is unsurprising that providing educational material was considered cost-effective
50
51 (Feuerstein et al., 2000; Rantonen et al., 2016; Slaughter et al., 2015).
52
53
54
55
56

57 To date, there is an abundance of educational material available to the general public in
58
59 several European languages outlining generic and some specific occupational cases (appendix
60

1
2
3 i). Much of this material, however, focuses on biomechanical aspects such as ergonomics
4 rather than adopting a contemporary understanding of WMSK. Furthermore, it is unclear
5 whether the material outlined from national registries or resources is based on scientific
6 evidence, on expert opinions, or a combination. Likewise, it is important that the employees
7 are provided with information specific to their work tasks and role. Here, it seems important
8 to acknowledge our understanding of health-related issues and technology is evolving
9 (Medicine, 2008), suggesting that educational material is constantly adapted to the latest
10 evidence. Electronic platforms, containing eHealth modules (Hutting et al., 2015b), would
11 allow central updating without the need to replace hard-copies as new evidence emerges.
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27

28 *Methodological considerations and limitations*

29
30 This scoping review only included studies focusing on educational interventions for managing
31 MSK pain in occupational settings. Therefore, the review did not include studies evaluating
32 the benefit of such interventions in non-occupational settings. It is conceivable that excluded
33 studies not performed in an occupational setting would have included working individuals..
34
35
36
37
38
39

40 With the inconclusive results in mind, it is important to illustrate that findings favoring
41 an educational intervention mainly came from non-randomized studies (Farrokhnia et al.,
42 2018; Feuerstein et al., 2000; Meinert et al., 2013; Slaughter et al., 2015; Videman et al., 2005;
43 Wanyonyi et al., 2015). This may indicate that any intervention aimed at improving MSK pain
44 in employees (in this case education) outperformed the option of doing nothing at all. A more
45 active approach such as physical exercise (Blangsted et al., 2008; Korshøj et al., 2018;
46 Rantonen et al., 2012) or ergonomic advice (Aghilinejad et al., 2016) seems to result in a
47 slightly better outcome. However, educational interventions have the advantage of being
48 cost-effective.
49
50
51
52
53
54
55
56
57
58
59
60

Conclusion

To date, there is no evidence to support that work-related MSK pain can be effectively avoided. Rather, evidence points towards the need for a shift in management strategies to reduce negative consequences of absenteeism and avoid pain-related loss of workability. Educational resources may be beneficial in this process as a stand-alone strategy and/or in combination with other, more active approaches. The positive effect from using educational resources for managing WMSK pain may relate to behavior changes that occur in- and outside the workplace. Delivering available education electronically may be most feasible and efficient.

Author contribution

All authors contributed significantly to the design of this scoping review and lived up to the requirements of the International Committee of Medical Journal Editors (ICMJE). No patients or other members of the public were involved in this work.

Funding and declarations

This study was funded by Erasmus+ Program (Agreement number 2018-2381/001-001, Project number 600920-EPP-1-2018-1-ES-EPPKA2-KA). The funding body had no influence on the outcome or interpretation of findings. None of the authors have any conflict of interest to report.

Data sharing

Upon request, the data used for this scoping review can made available

References

Aghilinejad M, Azar NS, Ghasemi MS, Dehghan N, Mokamelkhah EK. An ergonomic intervention to reduce musculoskeletal discomfort among semiconductor assembly workers. *Work* 2016;54:445–50. doi:10.3233/WOR-162325.

Aghilinejad M, Bahrami-Ahmadi A, Kabir-Mokamelkhah E, Sarebanha S, Hosseini HR, Sadeghi Z. The effect of three ergonomics training programs on the prevalence of low-back pain among workers of an Iranian automobile factory: a randomized clinical trial. *Int J Occup Environ Med* 2014;5:65–71.

Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19–32. doi:10.1080/1364557032000119616.

Blangsted AK, Sjøgaard K, Hansen EA, Hannerz H, Sjøgaard G. One-year randomized controlled trial with different physical-activity programs to reduce musculoskeletal symptoms in the neck and shoulders among office workers. *Scand J Work Environ Health* 2008;34:55–65.

de Boer AGEM, Burdorf A, van Duivenbooden C, Frings-Dresen MHW. The effect of individual counselling and education on work ability and disability pension: a prospective intervention study in the construction industry. *Occup Environ Med* 2007;64:792–7. doi:10.1136/oem.2006.029678.

Burdorf A, Jansen JP. Predicting the long term course of low back pain and its consequences for sickness absence and associated work disability. *Occup Environ Med* 2006;63:522–9. doi:10.1136/oem.2005.019745.

Busch H, Göransson S, Melin B. Self-efficacy beliefs predict sustained long-term sick absenteeism in individuals with chronic musculoskeletal pain. *Pain Pract* 2007;7:234–40.

1
2
3 doi:10.1111/j.1533-2500.2007.00134.x.
4

5 Caspi CE, Dennerlein JT, Kenwood C, Stoddard AM, Hopcia K, Hashimoto D, et al. Results of a
6 Pilot Intervention to Improve Health and Safety for Health Care Workers. *J Occup Environ*
7
8 *Med* 2013;55:1449–55. doi:10.1097/JOM.0b013e3182a7e65a.
9
10

11 da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: A systematic
12 review of recent longitudinal studies. *Am J Ind Med* 2010;53:285–323.
13
14

15 doi:10.1002/ajim.20750.
16
17

18 Curnock E, Leyland AH, Popham F. The impact on health of employment and welfare
19 transitions for those receiving out-of-work disability benefits in the UK. *Soc Sci Med*
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

2016;162:1–10. doi:10.1016/j.socscimed.2016.05.042.
Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies
in the United States and internationally. *Spine J* 2008;8:8–20.

doi:10.1016/j.spinee.2007.10.005.

Doda D, Rothmore P, Pisaniello D, Briggs N, Stewart S, Mahmood M, et al. Relative benefit of
a Stage of Change approach for the prevention of musculoskeletal pain and discomfort: A
cluster randomised trial. *Occup Environ Med* 2015;72. doi:10.1136/oemed-2015-102916.

Farrokhnia T, Rezai M, Vaziri M-H. Investigating the Effect of Educational Intervention on
Musculoskeletal Disorders in Dentists. *World Fam Med Journal/Middle East J Fam Med*
2018;16:307–13. doi:10.5742/MEWFM.2018.93275.

Feuerstein M, Marshall L, Shaw WS, Burrell LM. Multicomponent Intervention for Work-
Related Upper Extremity Disorders. *J Occup Rehabil* 2000;10:71–83.

doi:10.1023/A:1009493813003.

Frederiksen P, Indahl A, Andersen LL, Burton K, Hertzum-Larsen R, Bendix T. Can group-
based reassuring information alter low back pain behavior? A cluster-randomized controlled

1
2
3 trial. PLoS One 2017;12:e0172003. doi:10.1371/journal.pone.0172003.

4
5 Frost P, Haahr JP, Andersen JH. Reduction of pain-related disability in working populations: a
6
7 randomized intervention study of the effects of an educational booklet addressing
8
9 psychosocial risk factors and screening workplaces for physical health hazards. Spine (Phila
10
11 Pa 1976) 2007;32:1949–54. doi:10.1097/BRS.0b013e3181342659.

12
13
14 Gardner T, Refshauge K, McAuley J, Hübscher M, Goodall S, Smith L. Combined education
15
16 and patient-led goal setting intervention reduced chronic low back pain disability and
17
18 intensity at 12 months: a randomised controlled trial. Br J Sports Med 2019;bjsports-2018-
19
20 100080. doi:10.1136/bjsports-2018-100080.

21
22
23
24
25 GBD 2016 Disease and Injury Incidence and Prevalence Collaborators T, Abajobir AA, Abate
26
27 KH, Abbafati C, Abbas KM, Abd-Allah F, et al. Global, regional, and national incidence,
28
29 prevalence, and years lived with disability for 328 diseases and injuries for 195 countries,
30
31 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet
32
33 (London, England) 2017;390:1211–59. doi:10.1016/S0140-6736(17)32154-2.

34
35
36
37 Gram B, Holtermann A, Bültmann U, Sjøgaard G, Sjøgaard K. Does an exercise intervention
38
39 improving aerobic capacity among construction workers also improve musculoskeletal pain,
40
41 work ability, productivity, perceived physical exertion, and sick leave?: a randomized
42
43 controlled trial. J Occup Environ Med 2012;54:1520–6.

44
45
46
47 doi:10.1097/JOM.0b013e318266484a.

48
49 Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back
50
51 pain is and why we need to pay attention. Lancet (London, England) 2018;391:2356–67.
52
53
54 doi:10.1016/S0140-6736(18)30480-X.

55
56
57 Hazard RG, Reid S, Haugh LD, McFarlane G. A controlled trial of an educational pamphlet to
58
59 prevent disability after occupational low back injury. Spine (Phila Pa 1976) 2000;25:1419–23.
60

1
2
3 Hoe VC, Urquhart DM, Kelsall HL, Zamri EN, Sim MR. Ergonomic interventions for preventing
4 work-related musculoskeletal disorders of the upper limb and neck among office workers.
5
6

7
8 Cochrane Database Syst Rev 2018. doi:10.1002/14651858.CD008570.pub3.
9

10
11 Hutting N, Detaille SI, Engels JA, Heerkens YF, Staal JB, Nijhuis-van der Sanden MW.
12

13 Development of a self-management program for employees with complaints of the arm,
14 neck, and/or shoulder: an intervention mapping approach. *J Multidiscip Healthc*
15

16
17 2015a;8:307. doi:10.2147/JMDH.S82809.
18

19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Hutting N, Detaille SI, Heerkens YF, Engels JA, Staal JB, Nijhuis-van der Sanden MWG.
Experiences of Participants in a Self-Management Program for Employees with Complaints of
the Arm, Neck or Shoulder (CANS): A Mixed Methods Study. *J Occup Rehabil* 2017;27:35–48.
doi:10.1007/s10926-016-9630-9.

Hutting N, Staal JB, Engels JA, Heerkens YF, Detaille SI, Nijhuis-van der Sanden MWG. Effect
evaluation of a self-management programme for employees with complaints of the arm,
neck or shoulder: a randomised controlled trial. *Occup Environ Med* 2015b;72:852–61.
doi:10.1136/oemed-2015-103089.

Jensen JN, Karpatschhof B, Labriola M, Albertsen K. Do fear-avoidance beliefs play a role on
the association between low back pain and sickness absence? A prospective cohort study
among female health care workers. *J Occup Environ Med* 2010;52:85–90.
doi:10.1097/JOM.0b013e3181c95b9e.

Korshøj M, Birk Jørgensen M, Lidegaard M, Mortensen OS, Krustrup P, Holtermann A, et al.
Decrease in musculoskeletal pain after 4 and 12 months of an aerobic exercise intervention:
a worksite RCT among cleaners. *Scand J Public Health* 2018;46:846–53.
doi:10.1177/1403494817717833.

McDonald M, DiBonaventura M daCosta, Ullman S. Musculoskeletal pain in the workforce:

1
2
3 the effects of back, arthritis, and fibromyalgia pain on quality of life and work productivity. J

4
5
6 Occup Environ Med 2011;53:765–70. doi:10.1097/JOM.0b013e318222af81.

7
8 Medicine I of. Evidence-Based Medicine and the Changing Nature of Health Care.

9
10 Washington, D.C.: National Academies Press; 2008. doi:10.17226/12041.

11
12 Meinert M, König M, Jaschinski W. Web-based office ergonomics intervention on work-
13
14 related complaints: a field study. Ergonomics 2013;56:1658–68.

15
16
17 doi:10.1080/00140139.2013.835872.

18
19
20 Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred Reporting Items for

21
22 Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med

23
24
25 2009;6:e1000097. doi:10.1371/journal.pmed.1000097.

26
27 Nicholas MK. Importance of being collaborative for return to work with back pain. Pain

28
29
30 2018;159:1431–2. doi:10.1097/j.pain.0000000000001250.

31
32 Parent-Thirion A, Biletta I, Cabrita J, Vargas Llave O, Vermeulen G, Wilczynska A, et al. 6th

33
34
35 European Working Conditions Survey : 2017 update. 2017.

36
37 Rantonen J, Karppinen J, Vehtari A, Luoto S, Viikari-Juntura E, Hupli M, et al. Cost-

38
39 effectiveness of providing patients with information on managing mild low-back symptoms

40
41
42 in an occupational health setting. BMC Public Health 2016;16:316. doi:10.1186/s12889-016-

43
44
45 2974-4.

46
47 Rantonen J, Luoto S, Vehtari A, Hupli M, Karppinen J, Malmivaara A, et al. The effectiveness

48
49 of two active interventions compared to self-care advice in employees with non-acute low

50
51
52 back symptoms: a randomised, controlled trial with a 4-year follow-up in the occupational

53
54
55 health setting. Occup Environ Med 2012;69:12–20. doi:10.1136/oem.2009.054312.

56
57 Rantonen J, Vehtari A, Karppinen J, Luoto S, Viikari-Juntura E, Hupli M, et al. Face-to-face

58
59 information combined with a booklet versus a booklet alone for treatment of mild low-back

60

1
2
3 pain: a randomized controlled trial. *Scand J Work Environ Health* 2014;40:156–66.

4
5 doi:10.5271/sjweh.3398.

6
7
8 Rashid M, Kristofferzon M-L, Nilsson A, Heiden M. Factors associated with return to work
9
10 among people on work absence due to long-term neck or back pain: a narrative systematic
11
12 review. *BMJ Open* 2017;7:e014939. doi:10.1136/bmjopen-2016-014939.

13
14
15 Rasmussen CDN, Holtermann A, Jørgensen MB, Ørberg A, Mortensen OS, Søgaard K. A multi-
16
17 faceted workplace intervention targeting low back pain was effective for physical work
18
19 demands and maladaptive pain behaviours, but not for work ability and sickness absence:
20
21 Stepped wedge cluster randomised trial. *Scand J Public Health* 2016;44:560–70.
22
23

24
25 doi:10.1177/1403494816653668.

26
27
28 Ratzon NZ, Bar-Niv NA, Froom P. The effect of a structured personalized ergonomic
29
30 intervention program for hospital nurses with reported musculoskeletal pain: An assigned
31
32 randomized control trial. *Work* 2016;54:367–77. doi:10.3233/WOR-162340.

33
34
35 Ree E, Lie SA, Eriksen HR, Malterud K, Indahl A, Samdal O, et al. Reduction in sick leave by a
36
37 workplace educational low back pain intervention: A cluster randomized controlled trial.
38
39
40 *Scand J Public Health* 2016;44:571–9. doi:10.1177/1403494816653854.

41
42
43 Sennehed CP, Holmberg S, Axén I, Stigmar K, Forsbrand M, Petersson IF, et al. Early
44
45 workplace dialogue in physiotherapy practice improved work ability at 1-year follow-up-
46
47 WorkUp, a randomised controlled trial in primary care. *Pain* 2018;159:1456–64.

48
49 doi:10.1097/j.pain.0000000000001216.

50
51
52 Shorthouse FM, Roffi V, Tack C. Effectiveness of educational materials to prevent
53
54 occupational low back pain. *Occup Med (Chic Ill)* 2016;66:623–9.

55
56 doi:10.1093/occmed/kqw072.

57
58
59 Slaughter AL, Frith K, O'Keefe L, Alexander S, Stoll R. Promoting Best Practices for Managing
60

1
2
3 Acute Low Back Pain in an Occupational Environment. *Workplace Health Saf* 2015;63:408–
4
5 14; quiz 415. doi:10.1177/2165079915589034.

6
7
8 Sultan-Taïeb H, Parent-Lamarche A, Gaillard A, Stock S, Nicolakakis N, Hong QN, et al.

9
10 Economic evaluations of ergonomic interventions preventing work-related musculoskeletal
11
12 disorders: a systematic review of organizational-level interventions. *BMC Public Health*
13
14 2017;17:935. doi:10.1186/s12889-017-4935-y.

15
16
17 Tegner H, Frederiksen P, Esbensen BA, Juhl C. Neurophysiological Pain Education for Patients
18
19 With Chronic Low Back Pain: A Systematic Review and Meta-Analysis. *Clin J Pain*
20
21 2018;34:778–86. doi:10.1097/AJP.0000000000000594.

22
23
24
25 Traeger AC, Lee H, Hübscher M, Skinner IW, Moseley GL, Nicholas MK, et al. Effect of
26
27 Intensive Patient Education vs Placebo Patient Education on Outcomes in Patients With
28
29 Acute Low Back Pain: A Randomized Clinical Trial. *JAMA Neurol* 2018;76:161.
30
31
32 doi:10.1001/jamaneurol.2018.3376.

33
34
35 Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for
36
37 Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med* 2018;169:467.
38
39
40 doi:10.7326/M18-0850.

41
42
43 Verbeek JH, Martimo K-P, Kuijer PPFM, Karppinen J, Viikari-Juntura E, Takala E-P. Proper
44
45 manual handling techniques to prevent low back pain, a Cochrane systematic review. *Work*
46
47 2012;41 Suppl 1:2299–301. doi:10.3233/WOR-2012-0455-2299.

48
49
50 Videman T, Ojajärvi A, Riihimäki H, Troup JDG. Low back pain among nurses: a follow-up
51
52 beginning at entry to the nursing school. *Spine (Phila Pa 1976)* 2005;30:2334–41.

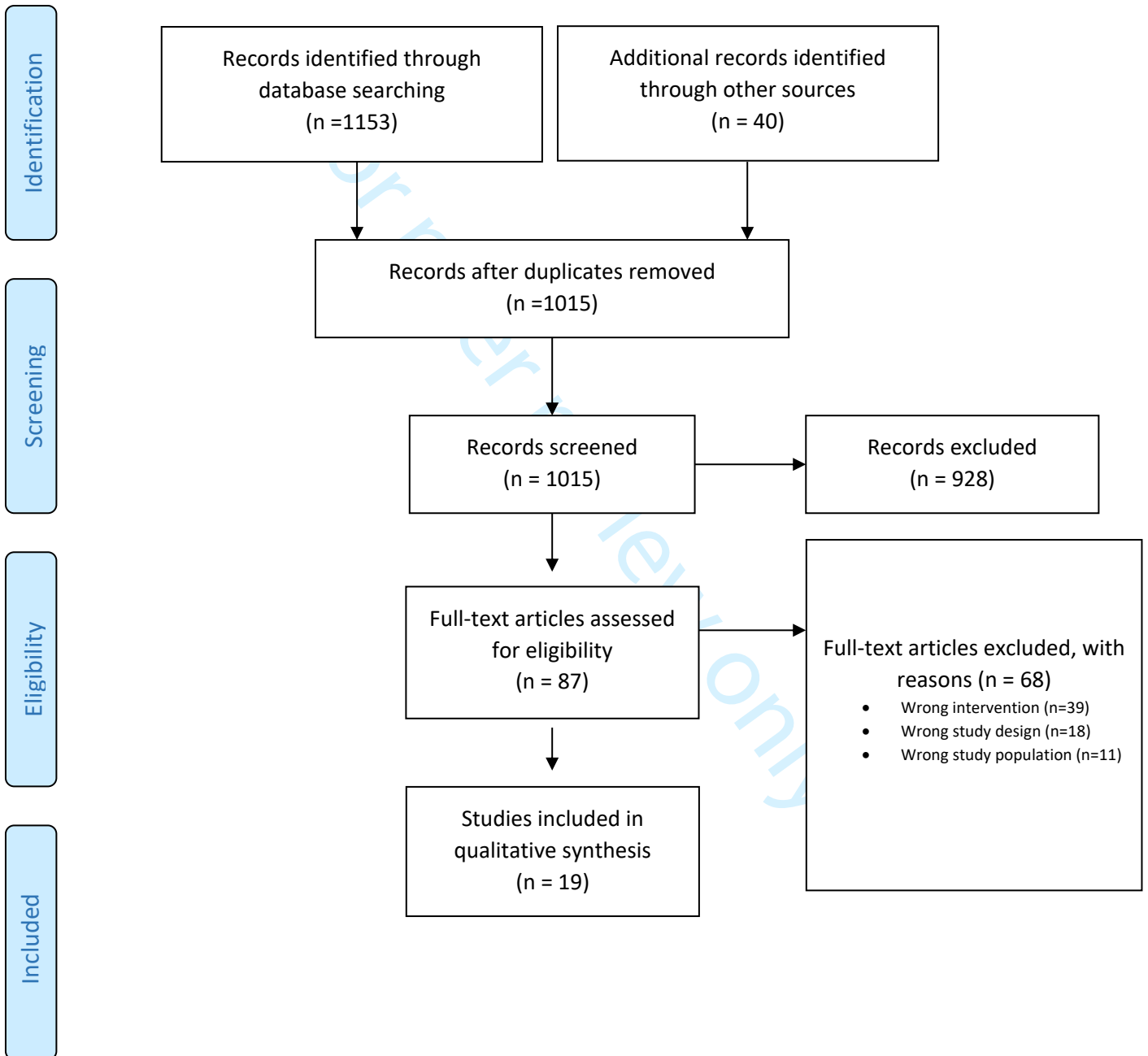
53
54
55 Videman T, Rauhala H, Asp S, Lindström K, Cedercreutz G, Kämppi M, et al. Patient-handling
56
57 skill, back injuries, and back pain. An intervention study in nursing. *Spine (Phila Pa 1976)*
58
59 1989;14:148–56.
60

1
2
3 Vlaeyen JWS, Maher CG, Wiech K, Van Zundert J, Meloto CB, Diatchenko L, et al. Low back
4 pain. Nat Rev Dis Prim 2018;4:52. doi:10.1038/s41572-018-0052-1.
5

6
7
8 Wanyonyi N, Frantz J, Saidi H. The effect of a knowledge-based ergonomic intervention
9 amongst administrators at Aga Khan University Hospital, Nairobi. Work 2015;52:843–54.
10
11
12
13 doi:10.3233/WOR-152133.
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Figure 1



Appendix i

Information that is made publicly available, free of charge, by the European Union, various public authorities, and trade unions.

Country	Source	Information available	Language	Link
EU common	European Agency for Safety and Health at Work	Guides and fact sheets related to work-related pain. Some fact sheets are available in various European languages.	Various EU-languages	link
	European Agency for Safety and Health at Work	Guides and fact sheets related to work-related pain. Some fact sheets are available in various European languages.	Various EU-languages	link
	World Health Organization	Prevention of musculoskeletal disorders in the workplace Information on risk factors and preventive measures for employers, delegates and trainers in occupational health Basic rules for preventive action	Various EU-languages	link

Austria	Portal der Arbeiterkammern	General information about rules and standards that should apply in the workplace with reference to the legislation. These cover e.g.: <ul style="list-style-type: none"> • Work environment • Working in hot and cold conditions • Working with chemical agents • Lighting in the workplace • Personal protective equipment • Sanitary and social facilities 	Austrian	Link
---------	----------------------------	---	----------	----------------------

Denmark	Branchefællesskabet for Arbejdsmiljø for velfærd og offentlig administration	General information regarding: <ul style="list-style-type: none"> • Psychological work environment • Physical health in the workplace • Noise, lighting and climate • Points for managing directors • Design and development of the workplace • Legal aspects at the workplace • Specific information aimed at different occupations For musculoskeletal pain, there are both brochures and videos focusing on ergonomics, exercises, and measures to prevent pain in the workplace	Danish	Link
---------	--	--	--------	----------------------

	The Danish Union of Public Employees (FOA)	General information regarding the work environment including: <ul style="list-style-type: none"> • Ergonomics • Pain in the workplace • Prevention of injury • Reporting an injury • Work place assessment 	Danish	Link
	The Danish Working Environment Authority	General information regarding the working environment including a large focus on musculoskeletal pain including: <ul style="list-style-type: none"> • Rules and regulations regarding musculoskeletal pain in the workplace • Pain in the workplace and how to prevent it • Help to self-help • Ergonomic advice • Taking a sick leave 	Danish	Link
	Videncenter for Arbejdsmiljø	General information regarding health and safety in the workplace. Specific section on musculoskeletal pain with suggestions regarding: <ul style="list-style-type: none"> • Prevention of pain in the workplace • What to do when you are in pain • Relationship between psychological problems and pain 	Danish	Link
	Health and Medicines Authorities in Denmark	Information for employees with pain in the body	Danish	link
	Danske Anlægsgartnere	Fact sheets and advice for work-related pain	Danish	link
	Workplace Denmark (Arbejdsmiljørådet)	Report on implementation of changes related to health on the workplace	Danish	link
	BFA-Service (Branchefællesskabet for arbejdsmiljø for service og tjenesteydelser)	Ergonomic advice for various work groups in the service sector (biomedical)	Danish	link
	Branchefællesskabet for arbejdsmiljø i industrien	Advice on how to handle pain for workers in the industry	Danish	link
	Branchefællesskabet for Arbejdsmiljø (BFA)	Ergonomic advice for employees in the financial sector	Danish	link
	Vidensråd for forebyggelse	Report: Prevention of injuries and diseases in muscles and joints (including a chapter on Work-related pain).	Danish	link

France	Université angers – Institut de veille sanitaire	Give extended information about upper limb musculoskeletal issues and indicators.	French	link
	Ministère du travail	Page treating about different levels of affectation, risk factors, prevention and health laws for employer	French	link
	Institute National de recherché et de securité	Document about musculoskeletal disorders, why they appear, how to react and prevent them. It also comments some popular belief	French	link

Germany	Krankheitserfahrungen	Information on chronic pain and related problems based on interviews with patients	German	link
	Betanet	Advice for people with work-related pain	German	link

Iceland	Administration of Occupational Safety and Health	Information regarding the promotion of health in the work place. Brochure	Icelandic	Link
---------	--	---	-----------	----------------------

Italy	Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro e le malattie professionali (INAIL)	I disturbi muscoloscheletrici lavorativi	Italian	Link
	National Institute for Insurance against Accidents at Work and Occupational Diseases (INAIL)	Musculoskeletal work disorders		
	www.inail.it			
	Fondazione Ergo Ergo Scientific Fundation	Le malattie professionali: una breve analisi economica	Italian	Link

		Occupational diseases: a brief economic analysis		
	Ministero del Lavoro e delle Politiche Sociali Ministry of Labor and Social Policies	Salute e sicurezza: Malattie professionali Health and safety with focus on Occupational diseases	Italian	Link
	Ministero della Salute Ministry of Health	Home > Temi e professioni > Ambiente e salute > Salute e sicurezza sul lavoro Home> Themes and professions> Environment and health> Health and safety at work	Italy	Link

Portugal	Inspeção-Geral das Atividades em Saúde	Manual of safety and health in the work This program focuses on the general principles of preventing work-related pain by focusing on: risk assessment, preventative measures (technical, organisational, social and ergonomic) and communication related to risk prevention at work	Portuguese	link
	Departamento de Segurança e Saúde no Trabalho.	Prevention of the lesions musculoskeletal related with the work	Portuguese	link

1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				

	Asociación Española de Especialistas en Medicina del Trabajo-AEEMT	All occupations expose workers to varied working conditions and it is accepted that work influences the health of workers, although regarding cervical and lumbar pain it is not known whether the predictive pain factors would be specific to the occupation. This is why some researchers have focused on identifying and identifying chronic neck and low back pain predictors in a specific cohort of office workers.	Spanish	link
	EGARSAT-Mutua Colaboradora con la Seguridad Social	It is necessary to maintain good working conditions. In prevention, order and cleanliness are basic elements that help us to keep our jobs properly tidy.	Spanish	link
	Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)	Prevention of musculoskeletal disorders in the health sector This text contains some good design and organisation practices, carried out over recent years in health sector centres forming partners of the working group, to reduce or minimise musculoskeletal disorders in the health sector.	Spanish	link
	Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)	Risks of musculoskeletal disorders in the Spanish workforce Overexertion continues to be the leading cause of occupational accident with discharge; its impact on the working population has not stopped growing for more than 20 years.	Spanish	link
	Comisiones Obreras de Castilla y León	Manual of musculoskeletal disorders In order to address the increasing problem of MSDs in the workplace and to address the lack of awareness among workers about occupational diseases, the Ministry of Labour Health has developed this manual for all those MSDs whose origins are at work so that they are not hidden as common illnesses, aimed at delegates and workers.	Spanish	link
	UGT-Andalucía	Ergonomic guide of disorders musculoskeletal In the prevention of musculoskeletal disorders, it is essential that our prevention delegates inform and facilitate training and participation channels for working people. With its editing and distribution in the workplaces, it will have a prevention tool, that, to be sure, will contribute to improve working conditions in Andalusia.	Spanish	link

	Junta de Andalucía. Consejería de Empleo	Approximation of ergonomic causes of work-related musculoskeletal disorders The aim of this study is to provide, through the analysis of work accidents and occupational diseases, an interesting insight into the branches of activity, types of work and occupations with the highest incidence of musculoskeletal disorders due to ergonomic deficiencies, and the nature of such deficiencies.	Spanish	link
	Instituto Canario de Seguridad Laboral	The disorders of musculoskeletal of work origin This brochure seeks to raise awareness of the importance of preventing overexertion at work.	Spanish	link
Sweden	Swedish work environment authority	Information regarding physical, psychological and chemical factors in the workplace and how these should be managed. An overview of the legislation regarding worker's rights, including which processes to follow in case of an accident	Swedish and English	Link
United Kingdom	National Health Service	Advice mainly focusing on back pain in the workplace regarding: <ul style="list-style-type: none"> • Sitting positions • Lifting • Implementing breaks in the workday • Treatment options 	English	Link
	Health and Safety Executive	Advice on Musculoskeletal Disorders in the work setting	English	Link
Romania	Ministerul muncii familiei, protecției sociale și persoanelor vârstnice, Institutul național de cercetare-dezvoltare pentru protecția muncii "Alexandru Darabont"	Guide for safety and health at work on manual handling of the persons The objective of the guide of good practice is to provide information relating to the assessment of the risks and the choice of appropriate measures for the protection of the health of workers and ensure the safety of their jobs involving manual handling of persons.	Romanian	Link

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* ;169:467–473. doi: 10.7326/M18-0850



BMJ Open

Education as a Strategy for Managing Occupational-related Musculoskeletal Pain: a scoping review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-032668.R1
Article Type:	Original research
Date Submitted by the Author:	11-Dec-2019
Complete List of Authors:	<p>Palsson, Thorvaldur; Aalborg University, Department of Health Science and Technology Boudreau, Shellie; Aalborg University Høgh, Morten ; Aalborg University, Department of Health Science and Technology Herrero, Pablo; San Jorge Univ, Physiotherapy Bellosta-Lopez, Pablo ; University of San Jorge Faculty of Health Sciences, Department of Physiotherapy Domenech-Garcia, Victor ; University of San Jorge Faculty of Health Sciences, Department of Physiotherapy Langella, Francesco; IRCCS Istituto Ortopedico Galeazzi, Orthopedic & Traumatology Gagni, Nicolo; IRCCS Istituto Ortopedico Galeazzi, Orthopedic & Traumatology Christensen, Steffan ; University College of Northern Denmark , Department of Physiotherapy; Aalborg Universitet, Department of Health Science and Technology Villumsen, Morten ; Aalborg Municipality; Aalborg University , Department of Health Science and Technology</p>
Primary Subject Heading:	Public health
Secondary Subject Heading:	Public health
Keywords:	Work-related musculoskeletal pain, Education, PAIN MANAGEMENT

SCHOLARONE™
Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Education as a Strategy for Managing Occupational-related Musculoskeletal Pain: a scoping review

Thorvaldur Skuli Palsson¹, Shellie A. Boudreau², Morten Høgh¹, Pablo Herrero³, Pablo Bellosta-López³, Victor Domenech-Garcia³, Francesco Langella⁴, Nicolò Gagni⁴, Steffan Wittrup McPhee Christensen^{1,5}, Morten Villumsen⁶

¹Department of Health Science and Technology, Aalborg University, Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

²Center for Neuroplasticity and Pain (CNAP), Department of Health Science and Technology, SMI®, Aalborg University, Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

³Department of Physiotherapy, University of San Jorge, Campus Universitario Villanueva de Gállego, Autovía Mudéjar, km. 299, 50830 Villanueva de Gállego, Zaragoza, Spain

⁴IRCCS Galeazzi Orthopedic Institute, Via Riccardo Galeazzi, 4, 20161 Milano MI, Italy

⁵ Department of Physiotherapy, University College of Northern Denmark, Selma Lagerløfs Vej 2 9220 Aalborg, Denmark

⁶Aalborg Municipality, Storemosevej 19, 9310 Aalborg, Denmark

Corresponding author

Thorvaldur Skuli Palsson

Associate Professor (PhD)

Department of Health Science and Technology, SMI®, Frederik Bajers Vej 7D, 9220 Aalborg, Denmark

tsp@hst.aau.dk

Telephone: +4599407518

Fax: +4599407520

1
2
3 **Keywords:** Work-related musculoskeletal pain, Pain Education, Pain management
4

5 **Word count:** 3134 words
6
7
8
9

10 **Abstract**

11
12
13
14
15 **Background:** Musculoskeletal (MSK) pain is the primary contributor to disability worldwide.
16
17 There is a growing consensus that MSK pain is as a recurrent multi-factorial condition
18
19 underpinned by health and lifestyle factors. Studies suggest that education on work-related
20
21 pain and individualized advice could be essential and effective for managing persistent MSK
22
23 pain. **Objective:** The objective of this scoping review was to map the existing educational
24
25 resources for work-related MSK (WRMSK) pain, and the effects of implementing educational
26
27 strategies in the workplace on managing WRMSK pain. **Methods:** This scoping review assessed
28
29 original studies that implemented and assessed education as a strategy to manage WMSK
30
31 pain. Literature search strategies were developed using thesaurus headings (i.e. MeSH and
32
33 CINAHL headings), and free-text search including words related to MSK in an occupational
34
35 setting. The search was carried out in PUBMED, CINAHL, COCHRANE LIBRARY and WEB OF
36
37 SCIENCE in the period 12.-14. February 2019. **Results:** A total of 19 peer-reviewed articles
38
39 were included and the study design, aim, and outcomes were summarized. Of the 19 peer-
40
41 reviewed articles, 10 RCT studies assessed the influence of education on work-related MSK
42
43 pain. Many studies provided a limited description of the education material and
44
45 assessed/utilized different methods of delivery. A majority of studies concluded education
46
47 positively influences work-related MSK pain. Further, some studies reported additive effects
48
49 of physical activity or ergonomic adjustments. **Conclusions:** There is a gap in knowledge
50
51 regarding the best content and delivery of education of material in the workplace. Although
52
53
54
55
56
57
58
59
60

1
2
3 beneficial outcomes were reported, more RCT studies are required to determine the effects
4
5 of education material as compared to other interventions, such as exercise or behavioral
6
7 therapy.
8
9

10 **Strengths and limitations**

- 13 • The study design allowed for including literature from non-randomized studies to
14 investigate the role of education for managing work-related musculoskeletal pain
15
 - 18 • The study presents a broad overview of resources available for healthcare professional
19 and the general public regarding work-related musculoskeletal pain
20
 - 23 • Relevant studies conducted in working populations may have been excluded if the
24 article did not state that the focus was on work-related pain
25
 - 28 • The scoping review search strategy was not peer-reviewed
29
- 30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Introduction

The socioeconomic impact of MSK pain-related disability and associated work absenteeism affects the individual worker, the family, the worker's organization, and society (1-4). Efforts to prevent work-related MSK (WMSK) pain by modifying the physical load seem inadequate (5, 6) and the lack of effects may pertain to the nature of MSK pain where e.g. psychological health and lifestyle-related factors play a significant role (2, 7, 8). Therefore, strategies for addressing WMSK pain require re-conceptualization (7, 9, 10) and inclusion of multifactorial approaches. Ultimately, re-conceptualizing the understanding of WMSK pain would imply an abandonment of a direct (causal) relation between work-related activities (e.g. sitting, lifting, and load) and WMSK pain. Instead, work-related activities should be considered one of many contributors to WMSK pain (4).

By accounting for the multidimensional nature of WMSK pain and individual variability, a previous interventional study (11) demonstrated a small, but significant pain reduction where the level of pain relief was significantly associated with the number of clinician-worker interactions. A similar effect was observed on return to work when a multidisciplinary approach including a brief two-session intervention with a healthcare professional (12).

From a socioeconomic perspective, enabling individuals return or continue to work despite having episodes of recurrent pain may be beneficial for the individual worker and the organization (13). In this regard, organizations should adopt a broad approach, appreciating the multidimensional nature of pain for ensuring workability instead of solely focusing on prevention and management of WMSK pain (14). Successful rehabilitation of WMSK may

1
2
3 depend upon better collaboration and communication between the organization, managers,
4 and the individual worker (10, 15). Furthermore, communicating education about work-
5 related pain and individualized advice could be essential for the management of persistent
6 MSK pain (16-18). In fact, communication of non-threatening information about MSK pain may
7 reduce absenteeism (19, 20). However, an overview of educational material for employees for
8 the self-management of WMSK pain, implementation strategies for pain management within
9 the workplace is lacking.

10
11 The objective of this scoping review was to map the existing educational resources
12 focusing on WMSK pain. Moreover, the objective was to provide an overview of the available
13 evidence on implementation of educational resources in occupational settings to help
14 managing WMSK pain.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 **Methods**

36 37 38 *Study design and literature search strategies*

39
40 This scoping review included original studies that implemented and assessed education as a
41 strategy to manage WMSK pain. A scoping review was chosen as a starting point to get a broad
42 overview of any existing evidence in the field. The reporting of this scoping review follows the
43 PRISMA-ScR guidelines (21).

44
45 The literature search strategy was developed to consider population, concept, and
46 context (PCC); Educational strategies to manage WMSK pain in a working population. For the
47 purpose of this scoping review, educational strategies were defined as an initiative designed
48 to educate the employees with the aim of promoting occupational health in the workplace.
49 Additionally, management strategy was defined as a method aimed at preventing or reducing

1
2
3 the burden of MSK pain in an occupational setting. Studies were included if the effect of
4 education was assessed in any way (i.e. as the primary intervention or control) and if they
5 were i) based on peer-reviewed research articles performed on adult humans (above 18
6 years), ii) had full-text available in English, iii) were focused on occupational-related pain in a
7 working population, and iv) described management strategies aimed at promoting retention
8 or wellbeing in the work place. A Prisma diagram, divided into the categories identification,
9 screening, eligibility and inclusion was used to document and guide the screening process as
10 recommended (22)(fig.1). After identification and removal of duplicates, studies were
11 excluded in the screening process (title and abstract) if i) no abstract was available, ii) they
12 were not in English or iii) if title and abstract indicated that the focus of the article was outside
13 the scope of the review. When screening for eligibility (full text), articles were excluded if i)
14 the intervention was wrong (i.e. non-educational), ii) the study design was wrong (e.g. opinion
15 papers or prevalence studies) or iii) if the study was conducted in a non-occupational context
16 (e.g. the educational intervention was not specifically aimed at a working population).

17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37 Literature search strategies were developed using thesaurus headings (i.e. MeSH and
38 CINAHL headings), and free-text search including words related to MSK in an occupational
39 setting. The search was carried out in PUBMED, CINAHL, COCHRANE LIBRARY and WEB OF
40 SCIENCE in the period 12.-14. February 2019. According to the indexing in PUBMED, the MeSH
41 term "*musculoskeletal pain*" only covers the terms *myalgia* and *pelvic girdle pain*. Therefore,
42 the MeSH terms "*Neck pain*", "*Back pain*" and "*Shoulder pain*" were added in the PUBMED
43 search, as these were the areas considered to be most frequently investigated and reported
44 in relation to occupational-related MSK pain (23). For a detailed description of the search
45 strategy in each database, see table 1. No restrictions on publication year were applied in
46 order to enable full mapping of the area. When all records had been identified using the
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 selection criteria, the reference lists of the included studies were screened to identify
4
5 additional relevant studies. All studies identified using the literature search strategies were
6
7 uploaded to Mendeley (*Mendeley Ltd., Elsevier, London 2019*) which was used for reference
8
9 management and removal of duplicates.
10
11
12
13
14

15 *Educational and information sources for employees*

16
17 Various educational resources regarding occupational health are available to the public in an
18
19 online format, e.g. the European Agency for Safety and Health at Work website
20
21 (www.osha.europa.eu). Although the credibility of these resources cannot be evaluated in a
22
23 scoping review, a mapping of such resources (grey literature) was performed to obtain a broad
24
25 overview of available educational resources for employees regarding MSK pain and how to
26
27 self-manage WMSK. For these purposes, a free-text Google search was conducted using
28
29 search terms relating to MSK in the workplace. Only resources from public authorities and
30
31 trade unions in Europe were included in the search.
32
33
34
35
36
37
38

39 *Study selection and synthesis of results*

40
41 The screening process consisted of two steps and an overview can be seen in figure 1. In the
42
43 first step, two investigators (TSP and SAB) independently identified potentially eligible articles
44
45 by screening the title and abstract. For calibration purposes, the two investigators compared
46
47 their findings after screening the first 100 papers from the first database (Pubmed). This was
48
49 done to improve the inter-rater reliability in the screening process. In the second step, the
50
51 same investigators reviewed a full-text version of the articles for eligibility. If consensus was
52
53 not reached, a third member of the research group (MV) had the final vote.
54
55
56
57
58
59
60

1
2
3 In the first step, articles were considered potentially eligible if the effects of education
4 in an occupational setting where MSK pain was specifically evaluated. Education focused on
5 the employees' understanding or knowledge on how to prevent and/or manage MSK pain in
6 an occupational setting.
7
8
9
10
11

12
13 The objective of this scoping review was to map existing evidence. With this study design
14 in mind, no attempt was made to critically evaluate the methodology or the overall confidence
15 in the results from the included articles as discussed by Arksey & O'Malley (24). To map the
16 existing evidence, the study design, objectives, method of delivery, and main findings from
17 the eligible articles were summarized and tabulated (table 2). The goal the scoping review was
18 to then provide an overview based on a qualitative synthesis covering the following three
19 themes:
20
21
22
23
24
25
26
27
28
29

- 30 • The overall outcome of using education to manage occupational-related MSK pain
- 31 • Potential influence of delivery method
- 32 • The individual workers' subjective evaluation of the educational intervention for
33 managing their occupational-related MSK pain
34
35
36
37
38
39

40 The qualitative synthesis included a distinction between the mode of education delivery,
41 which covered booklet/pamphlet, electronic resources (landing page or website), face-to-
42 face, or a combination.
43
44
45
46
47
48
49

50 *Patient and Public Involvement*

51
52 For this scoping review, patients' priorities, experience and preferences were not involved in
53 the design of the study, forming the aims, search strategies or data-syntheses. Study findings
54 will be disseminated on a publicly available platform (websites and on social media).
55
56
57
58
59
60

Results

After duplicate removal, the search strategy revealed 1015 articles. As outlined in figure 1, after excluding articles that did not fulfill the inclusion criteria based on screening of title and abstract (screening), 87 articles were included for full-text screening (eligibility). Following full-text screening additional 68 articles were excluded, leaving 19 peer-reviewed articles for final inclusion (inclusion). The included studies are listed in table 2 where information regarding study design, aim of the study, and outcomes of the three themes are presented. The two investigators (TSP and SAB) had an agreement of 75% after screening title and abstract. Consensus was reached in the remaining 25% without the involvement of the third investigator.

Characteristics of included studies

Of the 19 studies included, 10 studies were randomized controlled trials (25-34). Eight studies utilized a prospective design where educational management strategies were tested using one (35-39) or two groups (40-42). One study (43) utilized a mixed methods design to assess the individual workers' experience of the educational intervention. Further detail of the included studies can be found in table 2

Synthesis of findings

Components of education to manage occupational-related MSK pain

The content of the educational setup and content varied between the included studies where three themes for methods of delivery emerged: written material in a hard copy (e.g. pamphlet or book) (25, 27, 29, 32-34, 36, 41, 43), electronic delivery (29, 30, 38, 39) or a teacher-student setting (e.g. lecture or face-to-face teaching/mentoring) (25, 26, 28, 31, 35, 37, 40, 42). Some of these included studies employed a mixed approach where education was supplemented by a more active approach (see section: *Potential influence of delivery method* and table 2).

The overall outcome of using education to manage occupational-related MSK pain

The included studies were heterogeneous with regards to study design. Some studies lacked comparators (35-39) and others focused on improving physiological parameters such as aerobic capacity (28, 31) and strength (26). In general, a map of the existing evidence indicates that an educational intervention may positively influence musculoskeletal pain in the

1
2
3 workplace. Especially when including factors such as absence from work (26, 29, 33, 40, 41)
4
5 and cost-benefits of staying at work despite pain (37, 39, 41). However, it needs to be
6
7 acknowledged that favorable findings came from studies lacking a comparator (35-39). Also,
8
9 in some of the studies the educational arm was considered the control condition where the
10
11 focus was on improving physiological parameters such as aerobic capacity (28, 31) and
12
13 strength (26) suggesting that the power to detect significant changes in the educational arm
14
15 might have been insufficient.
16
17
18
19
20
21
22

23 *Potential influence of delivery method*

24
25 It is unclear from the included studies whether adding more active components to the
26
27 educational intervention with (i.e., additional verbal education, exercise, or multidisciplinary
28
29 rehabilitation). In this regard, adding ergonomic advice or exercise, was suggested to have
30
31 additional benefits (25, 33), although inconsistent findings were evident (27). For example,
32
33 combining an educational booklet with face-to-face advice resulted in little or no additive
34
35 effect on low back pain as assessed by pain levels, cost, or absence from work (32, 41). A face-
36
37 to-face intervention however may ensure better retention of the educational information as
38
39 compared to electronic delivery, such as through email (43).
40
41
42
43
44
45
46

47 *The individual workers' subjective evaluation of an educational intervention*

48
49 Three of the included studies (30, 39, 43) evaluated the subjective experience of participation
50
51 in the study. Hutting et al. investigated how six different online (eHealth) modules were
52
53 received by the participants (30). Overall, this initiative was considered positive as it provided
54
55 the participants with insight into their own condition and on how they could influence it
56
57 themselves by implementing behavior changes in- and outside the workplace. Behavioral
58
59
60

1
2
3 change can be facilitated by the information in the provided material regarding e.g.
4
5 ergonomics and exercise (at home and in the workplace). As a result, participants felt more
6
7 confident in self-managing their pain condition (39, 43). In contrast to this, many workers may
8
9 find it challenging to implement changes in their workplace as this might require unavailable
10
11 resources (e.g. office furniture and/or assistive equipment) (43).
12
13
14
15
16

17 *Educational and information sources for the general public*

18
19 A number of resources were found in several European countries (appendix i). The search was
20
21 confined to European countries. This was done to get an overview of the available resources
22
23 in countries with a similar structure with regards to organization of the occupational and
24
25 healthcare sectors. The available material was presented in writing, infographics, or video. All
26
27 of these resources were uni-directional in the sense that they did not have any interactive
28
29 features. The results from the literature search indicate an abundance of material. This
30
31 material was available in generic and less often, occupational specific, for employees in several
32
33 European languages.
34
35
36
37
38
39
40
41

42 **Discussion**

43
44 This scoping review aimed at mapping the available educational initiatives for managing MSK
45
46 pain at the workplace. The overall literature is heterogeneous and ranges between expert
47
48 statements to randomized control trials. The available literature does therefore not allow for
49
50 any conclusions on whether educational interventions are effective as a stand-alone
51
52 management strategy for WMSK pain. Also, it is unclear whether the method of delivery is an
53
54 important factor to consider and whether education needs to be combined with other
55
56 interventions.
57
58
59
60

Education as a means to manage work-related musculoskeletal pain

It is clear from the literature presented in this scoping review (table 2) that education is deemed relevant for managing MSK pain at the workplace. However, one could argue that a relationship between attention given to the individual and the perceived outcome exists. Offering more services or options, relevant to the job function and/or individual may have an additive effect on the outcome (33, 44).

The availability of educational material also seems to matter, i.e. that the employee feels that educational material can be accessed when needed (45). Also, it may be important that the intervention is directly related to the work functions of the employee in order to secure the relevance (46). When developing an eHealth educational module aimed at employees with MSK pain in the upper extremities and neck, Hutting et al. demonstrated a need to address both generic and specific work functions (47). By using an eHealth module for such purposes, employees gained insight and awareness about their complaints which ultimately improved acceptance and coping strategies (45). The educational information therefore should aim broadly and include the etiology of the pain experience, how emotional factors may play a role, how to deal with a high workload, considerations of available work capacity, and the ability to set limits. The educational material should aim to improve the employee's knowledge of the work environment, including communication with colleagues and superiors, which may involve how to ask for help (43).

Even though educational booklets may not be effective in preventing the onset of MSK pain, such as low back pain, beneficial may emerge as promoting behavioral change, modifying health beliefs, and improving attitudes (48). This is supported by information from one of the included articles (43), where the educational material was found to promote behavioral

1
2
3 change, when the participants adopted a more active lifestyle at work and during leisure time.
4
5 When weighing the effort against the potential gain, it is unsurprising that providing
6
7 educational material was considered cost-effective (37, 39, 41).
8
9

10 To date, an abundance of educational material is available to the general public in
11
12 several European languages outlining generic and some specific occupational cases (appendix
13
14 i). Much of this material, however, focuses on biomechanical aspects such as ergonomics
15
16 rather than adopting a contemporary understanding of WMSK. Furthermore, it is unclear
17
18 whether the material outlined from national registries or resources is based on scientific
19
20 evidence, on expert opinions, or a combination. Likewise, it is important that the employees
21
22 are provided with information specific to their work tasks and role. Here, it seems important
23
24 to acknowledge our understanding of health-related issues and technology is evolving (49),
25
26 suggesting that educational material is constantly adapted to the latest evidence. Electronic
27
28 platforms, containing eHealth modules (30), would allow central updating without the need
29
30 to replace hard-copies as new evidence emerges.
31
32
33
34
35
36
37
38
39

40 *Methodological considerations and limitations*

41
42 This scoping review only included studies focusing on educational interventions for managing
43
44 MSK pain in occupational settings. Therefore, the review did not include studies evaluating
45
46 the benefit of such interventions in non-occupational settings. It is conceivable that excluded
47
48 studies not performed in an occupational setting would have included working individuals. On
49
50 the same note, the literature search was limited to English only, which inevitably might have
51
52 excluded relevant information from scientific studies and other sources. In addition to this,
53
54 the search for educational and information sources for employees was confined to European
55
56 countries. This inevitably limited the number of educational resources in this review.
57
58
59
60

1
2
3 Subjecting the search strategy for peer-review could add rigor to the search strategy
4
5 (50). However, as an initial assessment in this area of scoping review this was considered
6
7 unnecessary. Nonetheless, future scoping reviews may benefit such a process.
8
9

10 It is important to illustrate that findings favoring an educational intervention mainly
11
12 came from non-randomized studies (36-39, 42, 43). This may indicate that any intervention
13
14 aimed at improving MSK pain in employees (in this case education) outperformed the option
15
16 of doing nothing at all. A more active approach such as physical exercise (26, 31, 33) or
17
18 ergonomic advice (25) seems to result in a slightly better outcome. However, educational
19
20 interventions have the advantage of being cost-effective.
21
22
23
24
25
26
27

28 **Conclusion**

29
30 Some of the articles included in this scoping review suggest that educational resources can
31
32 positively influence absenteeism and pain-related loss of workability. There is however, a gap
33
34 in knowledge regarding the best content and delivery of education of material in the
35
36 workplace. Although beneficial outcomes were reported, more RCT studies are required to
37
38 determine the effects of education material as compared to other interventions, such as
39
40 exercise or behavioral therapy.
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

57 **Author contribution**
58
59
60

1
2
3 All authors contributed significantly to the design of this scoping review and lived up to the
4 requirements of the International Committee of Medical Journal Editors (ICMJE). Author
5 contribution varied in the different phases of the project with TSP, SAB, and MV being involved
6 in all phases. TSP, SAB, MH, PH, and MV contributed to the conception, design, and planning
7 of the scoping review. TSP, SAB, MV, PBL, VDG, FL, NG, and SWC contributed to the data
8 collection, and TSP, SAB, and MV were responsible for data analysis. The interpretation of data
9 and writing of manuscript was led by TSP, SAB, and MV with support from MH, PH, PBL, VDG,
10 FL, NG, and SWC. No patients or other members of the public were involved in this work.
11
12
13
14
15
16
17
18
19
20
21
22
23
24

25 **Funding and declarations**

26
27 This study was funded by Erasmus+ Program (Agreement number 2018-2381/001-001, Project
28 number 600920-EPP-1-2018-1-ES-EPPKA2-KA). The funding body had no influence on the
29 outcome or interpretation of findings. None of the authors have any conflict of interest to
30 report.
31
32
33
34
35

36 **Data sharing**

37
38
39 Upon request, the data used for this scoping review can made available
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

References

1. Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. *The spine journal : official journal of the North American Spine Society*. 2008;8(1):8-20.
2. Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, Hoy D, Karppinen J, Pransky G, Sieper J, Smeets RJ, Underwood M. What low back pain is and why we need to pay attention. *Lancet (London, England)*. 2018;391(10137):2356-67.
3. McDonald M, DiBonaventura M, Ullman S. Musculoskeletal pain in the workforce: the effects of back, arthritis, and fibromyalgia pain on quality of life and work productivity. *Journal of occupational and environmental medicine*. 2011;53(7):765-70.
4. Vlaeyen JWS, Maher CG, Wiech K, Van Zundert J, Meloto CB, Diatchenko L, Battié MC, Goossens M, Koes B, Linton SJ. Low back pain. *Nature Reviews Disease Primers*. 2018;4(1):52.
5. Hoe VCW, Urquhart DM, Kelsall HL, Zamri EN, Sim MR. Ergonomic interventions for preventing work-related musculoskeletal disorders of the upper limb and neck among office workers. *Cochrane Database of Systematic Reviews*. 2018(10).
6. Verbeek JH, Martimo KP, Kuijer PP, Karppinen J, Viikari-Juntura E, Takala EP. Proper manual handling techniques to prevent low back pain, a Cochrane systematic review. *Work (Reading, Mass)*. 2012;41 Suppl 1:2299-301.
7. Jensen JN, Karpatschof B, Labriola M, Albertsen K. Do fear-avoidance beliefs play a role on the association between low back pain and sickness absence? A prospective cohort study among female health care workers. *Journal of occupational and environmental medicine*. 2010;52(1):85-90.
8. Rashid M, Kristofferzon M-L, Nilsson A, Heiden M. Factors associated with return to work among people on work absence due to long-term neck or back pain: a narrative systematic review. *BMJ Open*. 2017;7(6):e014939.
9. Nicholas MK. Importance of being collaborative for return to work with back pain. *Pain*. 2018;159(8):1431-2.
10. Sennehed CP, Holmberg S, Axen I, Stigmar K, Forsbrand M, Petersson IF, Grahn B. Early workplace dialogue in physiotherapy practice improved work ability at 1-year follow-up-WorkUp, a randomised controlled trial in primary care. *Pain*. 2018;159(8):1456-64.
11. Jay K, Brandt M, Hansen K, Sundstrup E, Jakobsen MD, Schraefel MC, Sjogaard G, Andersen LL. Effect of Individually Tailored Biopsychosocial Workplace Interventions on Chronic Musculoskeletal Pain and Stress Among Laboratory Technicians: Randomized Controlled Trial. *Pain Physician*. 2015;18(5):459-71.
12. Brendbekken R, Eriksen HR, Grasdahl A, Harris A, Hagen EM, Tangen T. Return to Work in Patients with Chronic Musculoskeletal Pain: Multidisciplinary Intervention Versus Brief Intervention: A Randomized Clinical Trial. *Journal of occupational rehabilitation*. 2017;27(1):82-91.
13. Curnock E, Leyland AH, Popham F. The impact on health of employment and welfare transitions for those receiving out-of-work disability benefits in the UK. *Social science & medicine (1982)*. 2016;162:1-10.
14. Rasmussen CD, Holtermann A, Jorgensen MB, Orberg A, Mortensen OS, Sogaard K. A multi-faceted workplace intervention targeting low back pain was effective for physical work demands and maladaptive pain behaviours, but not for work ability and sickness absence: Stepped wedge cluster randomised trial. *Scandinavian journal of public health*. 2016;44(6):560-70.
15. Sultan-Taieb H, Parent-Lamarche A, Gaillard A, Stock S, Nicolakakis N, Hong QN, Vezina M, Coulibaly Y, Vezina N, Berthelette D. Economic evaluations of ergonomic interventions preventing work-related musculoskeletal disorders: a systematic review of organizational-level interventions. *BMC public health*. 2017;17(1):935.

16. Gardner T, Refshauge K, McAuley J, Hübscher M, Goodall S, Smith L. Combined education and patient-led goal setting intervention reduced chronic low back pain disability and intensity at 12 months: a randomised controlled trial. *British Journal of Sports Medicine*. 2019;bjsports-2018-100080.
17. Tegner H, Frederiksen P, Esbensen BA, Juhl C. Neurophysiological Pain Education for Patients With Chronic Low Back Pain: A Systematic Review and Meta-Analysis. *The Clinical journal of pain*. 2018;34(8):778-86.
18. Traeger AC, Lee H, Hübscher M, Skinner IW, Moseley GL, Nicholas MK, Henschke N, Refshauge KM, Blyth FM, Main CJ, Hush JM, Lo S, McAuley JH. Effect of Intensive Patient Education vs Placebo Patient Education on Outcomes in Patients With Acute Low Back Pain: A Randomized Clinical Trial. *JAMA neurology*. 2018.
19. Frederiksen P, Indahl A, Andersen LL, Burton K, Hertzum-Larsen R, Bendix T. Can group-based reassuring information alter low back pain behavior? A cluster-randomized controlled trial. *PloS one*. 2017;12(3):e0172003.
20. Ree E, Lie SA, Eriksen HR, Malterud K, Indahl A, Samdal O, Harris A. Reduction in sick leave by a workplace educational low back pain intervention: A cluster randomized controlled trial. *Scandinavian journal of public health*. 2016;44(6):571-9.
21. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MDJ, Horsley T, Weeks L, Hempel S, Akl EA, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson MG, Garritty C, Lewin S, Godfrey CM, Macdonald MT, Langlois EV, Soares-Weiser K, Moriarty J, Clifford T, Tuncalp O, Straus SE. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of internal medicine*. 2018;169(7):467-73.
22. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*. 2009;6(7):e1000097.
23. Parent-Thirion A, Biletta I, Cabrita J, Vargas O, Vermeylen G, Wilczynska A, Wilkens M. Eurofound: Sixth European Working Conditions Survey – Overview report (2017 update). Luxembourg: Publications Office of the European Union; 2017.
24. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*. 2005;8(1):19-32.
25. Aghilinejad M, Azar NS, Ghasemi MS, Dehghan N, Mokamelkhah EK. An ergonomic intervention to reduce musculoskeletal discomfort among semiconductor assembly workers. *Work (Reading, Mass)*. 2016;54(2):445-50.
26. Blangsted AK, Sogaard K, Hansen EA, Hannerz H, Sjogaard G. One-year randomized controlled trial with different physical-activity programs to reduce musculoskeletal symptoms in the neck and shoulders among office workers. *Scandinavian journal of work, environment & health*. 2008;34(1):55-65.
27. Frost P, Haahr JP, Andersen JH. Reduction of pain-related disability in working populations: a randomized intervention study of the effects of an educational booklet addressing psychosocial risk factors and screening workplaces for physical health hazards. *Spine*. 2007;32(18):1949-54.
28. Gram B, Holtermann A, Bultmann U, Sjogaard G, Sogaard K. Does an exercise intervention improving aerobic capacity among construction workers also improve musculoskeletal pain, work ability, productivity, perceived physical exertion, and sick leave?: a randomized controlled trial. *Journal of occupational and environmental medicine*. 2012;54(12):1520-6.
29. Hazard RG, Reid S, Haugh LD, McFarlane G. A controlled trial of an educational pamphlet to prevent disability after occupational low back injury. *Spine*. 2000;25(11):1419-23.
30. Hutting N, Staal JB, Engels JA, Heerkens YF, Deltaille SI, Nijhuis-van der Sanden MW. Effect evaluation of a self-management programme for employees with complaints of the arm, neck or shoulder: a randomised controlled trial. *Occupational and environmental medicine*. 2015;72(12):852-61.
31. Korshoj M, Birk Jorgensen M, Lidegaard M, Mortensen OS, Krstrup P, Holtermann A, Sogaard K. Decrease in musculoskeletal pain after 4 and 12 months of an aerobic exercise

- 1
2
3 intervention: a worksite RCT among cleaners. *Scandinavian journal of public health*. 2018;46(8):846-
4 53.
- 5 32. Rantonen J, Vehtari A, Karppinen J, Luoto S, Viikari-Juntura E, Hupli M, Malmivaara A,
6 Taimela S. Face-to-face information combined with a booklet versus a booklet alone for treatment of
7 mild low-back pain: a randomized controlled trial. *Scandinavian journal of work, environment &*
8 *health*. 2014;40(2):156-66.
- 9 33. Rantonen J, Luoto S, Vehtari A, Hupli M, Karppinen J, Malmivaara A, Taimela S. The
10 effectiveness of two active interventions compared to self-care advice in employees with non-acute
11 low back symptoms: a randomised, controlled trial with a 4-year follow-up in the occupational health
12 setting. *Occupational and environmental medicine*. 2012;69(1):12-20.
- 13 34. Ratzon NZ, Bar-Niv NA, Froom P. The effect of a structured personalized ergonomic
14 intervention program for hospital nurses with reported musculoskeletal pain: An assigned
15 randomized control trial. *Work (Reading, Mass)*. 2016;54(2):367-77.
- 16 35. Caspi CE, Dennerlein JT, Kenwood C, Stoddard AM, Hopcia K, Hashimoto D, Sorensen
17 G. Results of a pilot intervention to improve health and safety for health care workers. *Journal of*
18 *occupational and environmental medicine*. 2013;55(12):1449-55.
- 19 36. Farrokhnia T, Rezai M, Vaziri M, Vaziri F. Investigating the Effect of Educational
20 Intervention on Musculoskeletal Disorders in Dentists. *WORLD FAMILY MEDICINE/MIDDLE EAST*
21 *JOURNAL OF FAMILY MEDICINE*. 2018;16(2):307-13.
- 22 37. Feuerstein M, L M, Shaw W, Burrell L. Multi-component intervention for work-related
23 upper extremity disorders. *Journal of Occupational Rehabilitation*. *Journal of occupational*
24 *rehabilitation*. 2000;10:71-83.
- 25 38. Meinert M, Konig M, Jaschinski W. Web-based office ergonomics intervention on
26 work-related complaints: a field study. *Ergonomics*. 2013;56(11):1658-68.
- 27 39. Slaughter AL, Frith K, O'Keefe L, Alexander S, Stoll R. Promoting Best Practices for
28 Managing Acute Low Back Pain in an Occupational Environment. *Workplace health & safety*.
29 2015;63(9):408-14; quiz 15.
- 30 40. de Boer AGEM, Burdorf A, van Duivenbooden C, Frings-Dresen MHW. The effect of
31 individual counselling and education on work ability and disability pension: a prospective
32 intervention study in the construction industry. *Occupational and environmental medicine*.
33 2007;64(12):792-7.
- 34 41. Rantonen J, Karppinen J, Vehtari A, Luoto S, Viikari-Juntura E, Hupli M, Malmivaara A,
35 Taimela S. Cost-effectiveness of providing patients with information on managing mild low-back
36 symptoms in an occupational health setting. *BMC public health*. 2016;16(1):316.
- 37 42. Videman T, Rauhala H, Asp S, Lindstrom K, Cedercreutz G, Kamppi M, Tola S, Troup JD.
38 Patient-handling skill, back injuries, and back pain. An intervention study in nursing. *Spine*.
39 1989;14(2):148-56.
- 40 43. Wanyonyi N, Frantz J, Saidi H. The effect of a knowledge-based ergonomic
41 intervention amongst administrators at Aga Khan University Hospital, Nairobi. *Work (Reading, Mass)*.
42 2015;52(4):843-54.
- 43 44. Aghilinejad M, Bahrami-Ahmadi A, Kabir E, Sarebanha S, Hosseini H, Sadeghi Z. The
44 Effect of Three Ergonomics Training Programs on the Prevalence of Low-Back Pain among Workers of
45 an Iranian Automobile Factory: A Randomized Clinical Trial. *The international journal of occupational*
46 *and environmental medicine*. 2014;5:65-71.
- 47 45. Hutting N, Detaille SI, Heerkens YF, Engels JA, Staal JB, Nijhuis-van der Sanden MW.
48 Experiences of Participants in a Self-Management Program for Employees with Complaints of the
49 Arm, Neck or Shoulder (CANS): A Mixed Methods Study. *Journal of occupational rehabilitation*.
50 2017;27(1):35-48.
- 51 46. Doda D, Rothmore P, Pisaniello D, Briggs N, Stewart S, Mahmood M, Hiller JE. Relative
52 benefit of a stage of change approach for the prevention of musculoskeletal pain and discomfort: a
53 cluster randomised trial. *Occupational and environmental medicine*. 2015;72(11):784-91.
- 54
55
56
57
58
59
60

- 1
2
3 47. Hutting N, Detaille SI, Engels JA, Heerkens YF, Staal JB, Nijhuis-van der Sanden MW.
4 Development of a self-management program for employees with complaints of the arm, neck,
5 and/or shoulder: an intervention mapping approach. *Journal of multidisciplinary healthcare*.
6 2015;8:307-20.
7
8 48. Shorthouse FM, Roffi V, Tack C. Effectiveness of educational materials to prevent
9 occupational low back pain. *Occupational medicine (Oxford, England)*. 2016.
10 49. Medicine Io. Evidence-Based Medicine and the Changing Nature of Health Care: 2007
11 IOM Annual Meeting Summary. McClellan MB, McGinnis JM, Nabel EG, Olsen LM, editors.
12 Washington, DC: The National Academies Press; 2008. 202 p.
13 50. McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer
14 Review of Electronic Search Strategies: 2015 Guideline Statement. *Journal of clinical epidemiology*.
15 2016;75:40-6.
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Table 1. Search strategy for all the included databases.

Source	Thesaurus headings / free-text search	Results	Date of search
PUBMED	Occupational health	29074	14.02.2019
	Musculoskeletal pain	3864	
	Neck pain	6264	
	Back pain	35590	
	Shoulder pain	4331	
	"Occupational health" AND "Musculoskeletal pain"	288	
	((("Musculoskeletal Pain"[Mesh]) OR "Neck Pain"[Mesh]) OR "Back Pain"[Mesh]) OR "Shoulder Pain"[Mesh]) AND "Occupational Health"[Mesh]	410	
CINAHL	Occupational health	39950	11.02.2019
	Musculoskeletal pain	3943	
	"Occupational health" AND "musculoskeletal pain"	125	
Cochrane database	Occupational health	562	14.02.2019
	musculoskeletal pain	694	
	"Occupational health" AND "musculoskeletal pain"	135	
	("Occupational health" [Mesh]) AND ("musculoskeletal pain" [Mesh])	40	
Web of Science	"Occupational health" AND "musculoskeletal pain"	155	12.02.2019
Total number of hits		1153	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Table 2. Table 2. The table depicts the study design, aim, and outcome of the included studies. Likewise, it depicts the country the study was conducted in, the occupational group in focus and the mode of delivery. The articles are presented in a chronological order.

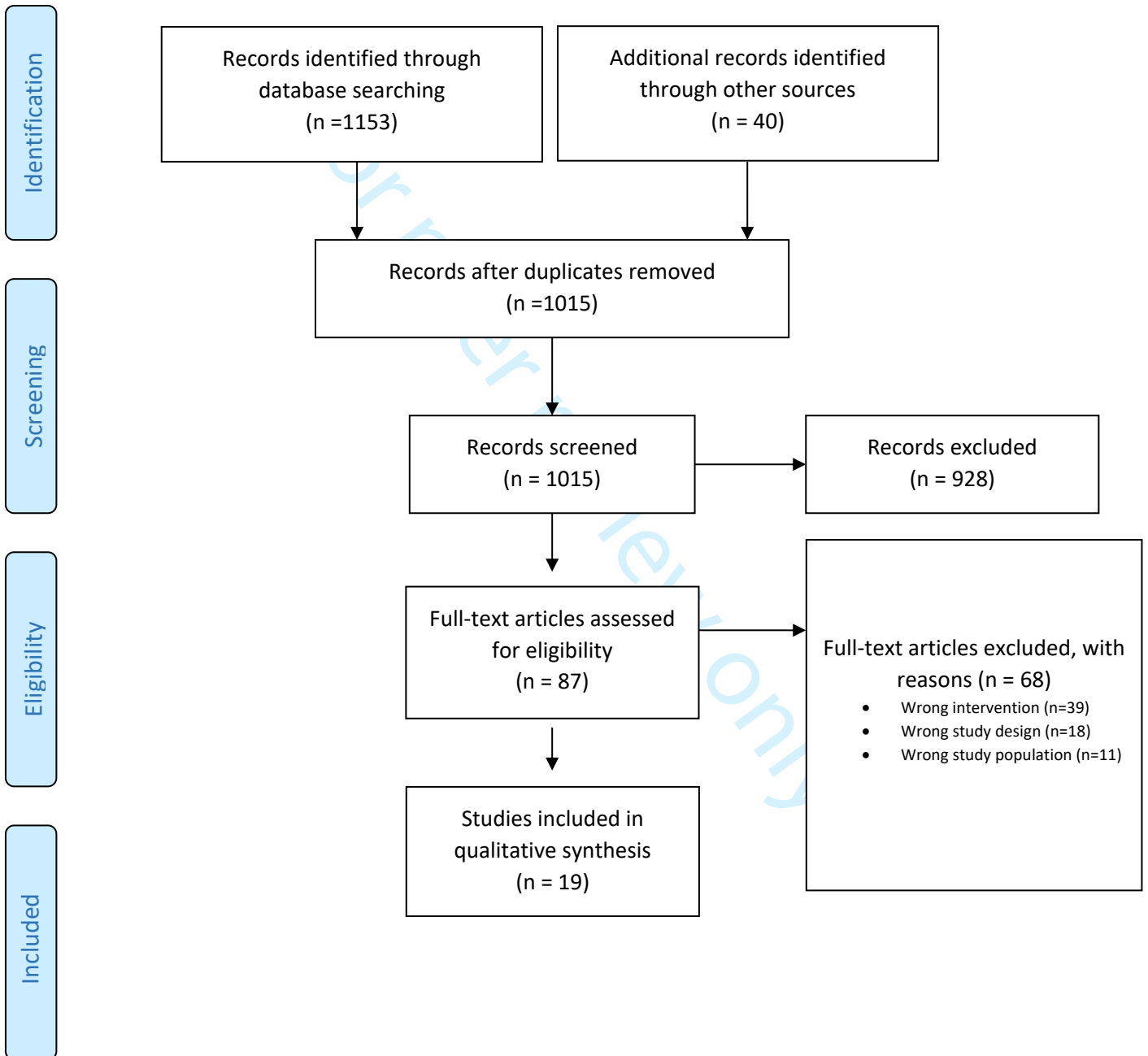
Author	Study design	Country	Main aim of study	Target group	Method of delivery	Data collection period	Outcome
Farrokhnia et al (36)	Prospective cohort study – single arm	Iran	Evaluate the effect of education related to good body posture and stretching exercises on musculoskeletal pain	Dentists	Educational pamphlets	Measurements conducted at baseline and two months after intervention	A significant reduction in musculoskeletal pain in neck, right shoulder, left shoulder, upper back, and right wrist following the educational intervention
Korshøj et al (31)	Randomized controlled trial	Denmark	Evaluate the effect of aerobic exercise on musculoskeletal pain at 4- and 12-months follow-up. The aerobic exercise group was compared with a health promotion group receiving lectures	Cleaners	Five two hour long lectures (control arm)	Measurements conducted at baseline, at four months and 12 months follow-up after intervention	Clinically significant reductions in pain intensity for neck, shoulders, arms/wrists in the aerobic exercise group, compared to the education group A reduction in low back pain within the health promotion group evident at 12-month follow-up.
Rantonen et al (41)	Prospective quasi experimental study	Finland	To assess cost-effectiveness of a patient information booklet for employees in forestry company reporting mild low back pain	Employees in a forestry company	Booklet or booklet + a face-to-face review of the booklet	Measurements conducted at baseline and at 3, 6, 12, and 24 months follow-up	Combination of booklet information and face-to-face advice reduced the costs of health care (87 % probability), but the additive effect (compared to booklet alone) was negligible.
Ratzon et al (34)	An assigned randomized control trial	Israel	To examine the effect of a personalized ergonomic intervention, focusing on body posture during common work tasks, as compared to a control group receiving instructions sheets and explanations of principles of proper work performance, for hospital nurses with musculoskeletal pain	Nurses working in a hospital setting	An instructions sheet (control group)	Measurements conducted at baseline with follow-up after 6 months	No significant differences were found in the level of pain or number of painful body regions or in the level between the intervention and control group that only got information/education in writing (no practical exercise/instructions)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Hutting et al (30)	A randomized control trial	The Netherlands	To evaluate the effectiveness of a self-management intervention (including an eHealth module), compared with usual care, in employees with chronic, non-specific complaints of the arm, neck or shoulder	University and general population	Group sessions (6) supplemented by an eHealth module (available for 12 months)	Measurements at baseline, at 3, 6 and 12 months	No significant between-group differences were found on most outcome measures, although the self-management intervention improved the participants' perceived disability during work.
--------------------	----------------------------	-----------------	--	-----------------------------------	--	---	--

For peer review only

Figure 1



Appendix i

Information that is made publicly available, free of charge, by the European Union, various public authorities, and trade unions.

Country	Source	Information available	Language	Link
EU common	European Agency for Safety and Health at Work	Guides and fact sheets related to work-related pain. Some fact sheets are available in various European languages.	Various EU-languages	link
	World Health Organization	Prevention of musculoskeletal disorders in the workplace Information on risk factors and preventive measures for employers, delegates and trainers in occupational health Basic rules for preventive action	Various EU-languages	link
Austria	Portal der Arbeiterkammern	General information about rules and standards that should apply in the workplace with reference to the legislation. These cover e.g.: <ul style="list-style-type: none"> • Work environment • Working in hot and cold conditions • Working with chemical agents • Lighting in the workplace • Personal protective equipment • Sanitary and social facilities 	Austrian	Link
Denmark	Branchefællesskabet for Arbejdsmiljø for velfærd og offentlig administration	General information regarding: <ul style="list-style-type: none"> • Psychological work environment • Physical health in the workplace • Noise, lighting and climate • Points for managing directors • Design and development of the workplace • Legal aspects at the workplace • Specific information aimed at different occupations For musculoskeletal pain, there are both brochures and videos focusing on ergonomics, exercises, and measures to prevent pain in the workplace	Danish	Link

	The Danish Union of Public Employees (FOA)	General information regarding the work environment including: <ul style="list-style-type: none"> • Ergonomics • Pain in the workplace • Prevention of injury • Reporting an injury • Work place assessment 	Danish	Link
	The Danish Working Environment Authority	General information regarding the working environment including a large focus on musculoskeletal pain including: <ul style="list-style-type: none"> • Rules and regulations regarding musculoskeletal pain in the workplace • Pain in the workplace and how to prevent it • Help to self-help • Ergonomic advice • Taking a sick leave 	Danish	Link
	Videncenter for Arbejdsmiljø	General information regarding health and safety in the workplace. Specific section on musculoskeletal pain with suggestions regarding: <ul style="list-style-type: none"> • Prevention of pain in the workplace • What to do when you are in pain • Relationship between psychological problems and pain 	Danish	Link
	Health and Medicines Authorities in Denmark	Information for employees with pain in the body	Danish	link
	Danske Anlægsgartnere	Fact sheets and advice for work-related pain	Danish	link
	Workplace Denmark (Arbejdsmiljørådet)	Report on implementation of changes related to health on the workplace	Danish	link
	BFA-Service (Branchefællesskabet for arbejdsmiljø for service og tjenesteydelser)	Ergonomic advice for various work groups in the service sector (biomedical)	Danish	link
	Branchefællesskabet for arbejdsmiljø i industrien	Advice on how to handle pain for workers in the industry	Danish	link
	Branchefællesskabet for Arbejdsmiljø (BFA)	Ergonomic advice for employees in the financial sector	Danish	link
	Vidensråd for forebyggelse	Report: Prevention of injuries and diseases in muscles and joints (including a chapter on Work-related pain).	Danish	link

France	Université angers – Institut de veille sanitaire	Give extended information about upper limb musculoskeletal issues and indicators.	French	link
	Ministère du travail	Page treating about different levels of affectation, risk factors, prevention and health laws for employer	French	link
	Institute National de recherché et de sécurité	Document about musculoskeletal disorders, why they appear, how to react and prevent them. It also comments some popular belief	French	link

Germany	Krankheitserfahrungen	Information on chronic pain and related problems based on interviews with patients	German	link
	Betanet	Advice for people with work-related pain	German	link

Iceland	Administration of Occupational Safety and Health	Information regarding the promotion of health in the work place. Brochure	Icelandic	Link
---------	--	--	-----------	----------------------

Italy	Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro e le malattie professionali (INAIL)	I disturbi muscoloscheletrici lavorativi	Italian	Link
	National Institute for Insurance against Accidents at Work and Occupational Diseases (INAIL)	Musculoskeletal work disorders		
	www.inail.it			
	Fondazione Ergo Ergo Scientific Fundation	Le malattie professionali: una breve analisi economica	Italian	Link

		Occupational diseases: a brief economic analysis		
	Ministero del Lavoro e delle Politiche Sociali Ministry of Labor and Social Policies	Salute e sicurezza: Malattie professionali Health and safety with focus on Occupational diseases	Italian	Link
	Ministero della Salute Ministry of Health	Home > Temi e professioni > Ambiente e salute > Salute e sicurezza sul lavoro Home> Themes and professions> Environment and health> Health and safety at work	Italy	Link

Portugal	Inspeção-Geral das Atividades em Saúde	Manual of safety and health in the work This program focuses on the general principles of preventing work-related pain by focusing on: risk assessment, preventative measures (technical, organisational, social and ergonomic) and communication related to risk prevention at work	Portuguese	link
	Departamento de Segurança e Saúde no Trabalho.	Prevention of the lesions musculoskeletal related with the work	Portuguese	link

	Instituto Sindical de Trabajo, Medio Ambiente y Salud	<p>Workplace Risk Prevention tools for SMEs Health Damage. Musculoskeletal Disorders (MSDs)</p> <ul style="list-style-type: none"> - Health consequences due to lack of ergonomics in the workplace Musculoskeletal disorders: concept, characteristics and evolution - More frequent musculoskeletal disorders and their main causes - Main musculoskeletal disorders: affected areas and pathologies. - Case study: health damage from musculoskeletal disorders. - Qualification of musculoskeletal disorders: accidents at work and occupational diseases. - Baseline: business obligations and classification of MSDs 	Spanish	Link
	Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)	The various states of health (diseases, disorders and damage) refer to functional or structural losses and are associated with health risk. Pain, as a primary symptom, is often associated with work related musculoskeletal disorder. Pain, which is an example of health status, is the most commonly used health indicator.	Spanish	link
	Secretaría General Subdirección General Recursos Humanos Área de Prevención de Riesgos Laborales	In this manual, in order to be able to approach the knowledge of these disorders and act preventively, they will try: to inform the normative aspects that affect the worker more directly; Define musculoskeletal disorders (MSDs); Summarize symptoms that appear most often to identify MSDs; See the causes of some alterations; Provide strategies to prevent the emergence of MSDs, and recommendations for performing work in ergonomically correct conditions.	Spanish	link
	Ministerio de Trabajo e Investigación, Secretaria de Estado de Seguridad Social	<p>Musculoskeletal disorders, psychopathology and pain</p> <p>To investigate the existing interrelationship in musculoskeletal disorders, psychopathology and pain, to reveal the mutual interconnectedness of this affection in the determination and prolongation of the duration and number of processes due to Temporary Work Incapacity, which has allowed to situate musculoskeletal disorders in the first-incapacity.</p>	Spanish	link

	Asociación Española de Especialistas en Medicina del Trabajo-AEEMT	All occupations expose workers to varied working conditions and it is accepted that work influences the health of workers, although regarding cervical and lumbar pain it is not known whether the predictive pain factors would be specific to the occupation. This is why some researchers have focused on identifying and identifying chronic neck and low back pain predictors in a specific cohort of office workers.	Spanish	link
	EGARSAT-Mutua Colaboradora con la Seguridad Social	It is necessary to maintain good working conditions. In prevention, order and cleanliness are basic elements that help us to keep our jobs properly tidy.	Spanish	link
	Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)	Prevention of musculoskeletal disorders in the health sector This text contains some good design and organisation practices, carried out over recent years in health sector centres forming partners of the working group, to reduce or minimise musculoskeletal disorders in the health sector.	Spanish	link
	Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)	Risks of musculoskeletal disorders in the Spanish workforce Overexertion continues to be the leading cause of occupational accident with discharge; its impact on the working population has not stopped growing for more than 20 years.	Spanish	link
	Comisiones Obreras de Castilla y León	Manual of musculoskeletal disorders In order to address the increasing problem of MSDs in the workplace and to address the lack of awareness among workers about occupational diseases, the Ministry of Labour Health has developed this manual for all those MSDs whose origins are at work so that they are not hidden as common illnesses, aimed at delegates and workers.	Spanish	link
	UGT-Andalucía	Ergonomic guide of disorders musculoskeletal In the prevention of musculoskeletal disorders, it is essential that our prevention delegates inform and facilitate training and participation channels for working people. With its editing and distribution in the workplaces, it will have a prevention tool, that, to be sure, will contribute to improve working conditions in Andalusia.	Spanish	link

	Junta de Andalucía. Consejería de Empleo	Approximation of ergonomic causes of work-related musculoskeletal disorders The aim of this study is to provide, through the analysis of work accidents and occupational diseases, an interesting insight into the branches of activity, types of work and occupations with the highest incidence of musculoskeletal disorders due to ergonomic deficiencies, and the nature of such deficiencies.	Spanish	link
	Instituto Canario de Seguridad Laboral	The disorders of musculoskeletal of work origin This brochure seeks to raise awareness of the importance of preventing overexertion at work.	Spanish	link
Sweden	Swedish work environment authority	Information regarding physical, psychological and chemical factors in the workplace and how these should be managed. An overview of the legislation regarding worker's rights, including which processes to follow in case of an accident	Swedish and English	Link
United Kingdom	National Health Service	Advice mainly focusing on back pain in the workplace regarding: <ul style="list-style-type: none"> • Sitting positions • Lifting • Implementing breaks in the workday • Treatment options 	English	Link
	Health and Safety Executive	Advice on Musculoskeletal Disorders in the work setting	English	Link
Romania	Ministerul muncii familiei, protecției sociale și persoanelor vârstnice, Institutul național de cercetare-dezvoltare pentru protecția muncii "Alexandru Darabont"	Guide for safety and health at work on manual handling of the persons The objective of the guide of good practice is to provide information relating to the assessment of the risks and the choice of appropriate measures for the protection of the health of workers and ensure the safety of their jobs involving manual handling of persons.	Romanian	Link

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* ;169:467–473. doi: 10.7326/M18-0850



St. Michael's

Inspired Care.
Inspiring Science.

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>